

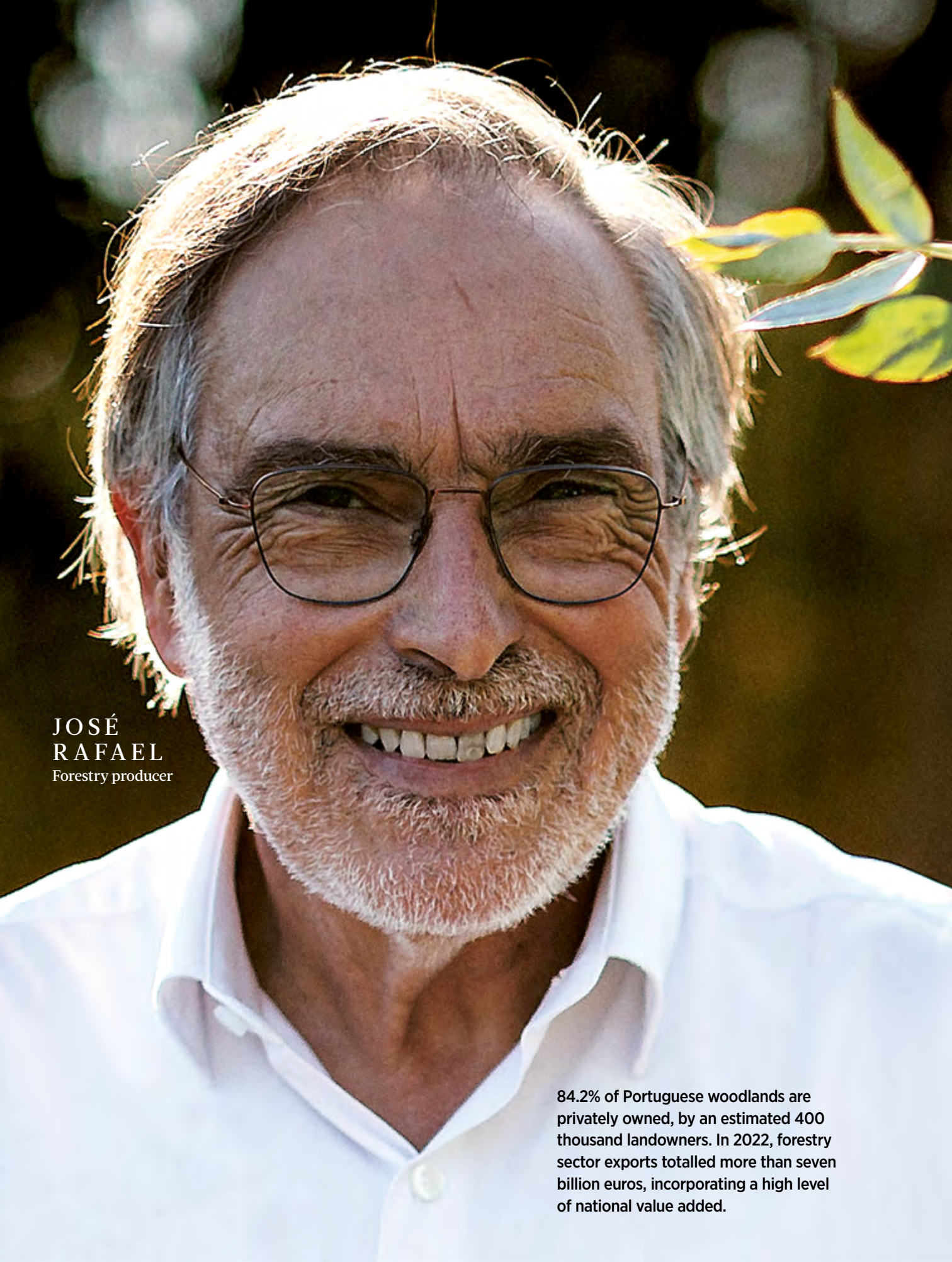
MARCH 2024

MY PLANET

by The Navigator Company

**CARLOTA
LISBOA**
Forestry producer

More than a third of Portugal is covered by forest, with native species representing 72%. Forests provide direct employment for 100 thousand people and also account for 10% of the country's exports and 6% of GDP. They protect water resources and the soil, preserve biodiversity, and sequester an annual average of 5.6 million tons of CO₂. They are vital to the future of the country and its people.



**JOSÉ
RAFAEL**
Forestry producer

84.2% of Portuguese woodlands are privately owned, by an estimated 400 thousand landowners. In 2022, forestry sector exports totalled more than seven billion euros, incorporating a high level of national value added.



**FRANCISCO
FREIRE**
Forestry manager

Woodlands (forests, brushland, and non-productive land) occupy 6.2 million hectares (69.4%) in mainland Portugal. Forests (counting forested and temporarily deforested land) represent the main form of land use in the country (36%).



**JORGE
COTRIM**
Production
manager

The forests of mainland Portugal are dominated by native species, most notably oak (including cork oaks and holm oaks, approximately 36% of the total) and pine (approximately 30%). Eucalyptus accounts for 26% of the forested area.



**PATRÍCIA
MOREIRA**
Researcher

The new bioproducts that are emerging from forests range from food additives to biocomposites, and from advanced biofuels to nanocellulose, substituting fossil-based materials.



JOÃO
SILVA
Mycologist

Forests provide produce such as mushrooms and honey, and also ecosystems for recreation and storing carbon. In Portugal, the most valuable service is recreational use of the countryside, valued at approximately 2.3 billion euros (54% of the total value of the country's ecosystems). Carbon sequestration is worth 344.7 million euros.



RUI
MATALOTO
Archaeologist

Forests play a vital role in conservation, safeguarding both biological resources and cultural heritage. In the area managed by The Navigator Company alone, almost 300 cultural heritage sites are identified and protected.



**ANTÓNIO
AIRES**
Forestry
engineer

21.8% of Portugal's forests consist of protected areas, given over primarily to conserving biodiversity. In the areas managed by The Navigator Company, 253 species of fauna have been identified, along with around a thousand species and sub-species of flora.



Portugal's planted forests are the foundation of a value chain that generates employment across the country. There are more than 19,500 enterprises in the forestry sector, employing more than 100 thousand people.

**RUI
SILVA**
Common
land officer

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Commercially planted forests also buzz with life.



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In Portugal, as in the rest of Europe, little remains of the original forests, untouched by man: only around 0.66% of Portugal's forests are native woodlands. Planting has been crucial to the growth of the country's forested area.

A green miracle

Forests are the green lungs of the planet, silently securing our survival and well-being. They play a crucial role in preserving an ecological balance and in sustainable socio-economic development.

The world's population has reached 8 billion people and grew by 75 million in the last year alone. These are figures that invite us to celebrate the advances in healthcare, which have increased our average life expectancy and slashed rates of infant and maternal mortality. But they are also a warning about the sustainability of the planet, because more people means more pressure on resources. The concept of sustainable development reflects precisely this awareness of our limited resources, and of the need to meet our present needs without compromising those of future generations. In other words, in the context of population growth, development is needed to create jobs and improve living standards, but industrial progress must balance economic, social and ecological factors. How? By shifting from a linear, fossil-based economy to a circular bioeconomy paradigm that works in harmony with nature. Forests are a unique resource for achieving this balance, thanks to their ability to respond to multiple needs, and their extraordinary capacity to renew themselves. The wide range of products and services that forests can offer creates opportunities for responding to many of the most urgent challenges posed by sustainable development.

Forests can bring countless benefits, by storing CO₂, producing oxygen and generating biomass, which can be converted into bioproducts able to substitute products currently obtained from petrochemicals.

The power of planted forests
The United Nations Food and Agriculture Organisation (FAO) has identified two broad categories of forests in a report entitled "Global Forest Resources Assessment": naturally regenerating forests (also called "natural forest") and planted forests. And it states that, "when sustainably managed, planted forests can help reduce the logging pressure on natural forests, and some can also provide important ecosystem services". Planted forests therefore play a central role in the worldwide bioeconomy. The aims set out in the UN's 14-year Strategic Plan for Forests (2017-2030) include a significant increase in the areas of sustainably managed forests, as well as in the proportion of forestry products sourced from these areas. According to the FAO, "an increase in the area of forests and sustainable forestry management can support a green recovery and a transition to carbon neutral economies".

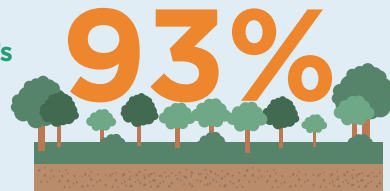
Forests cover **31%** OF THE EARTH'S SURFACE (4.06 billion hectares)



420 million hectares of forests lost to deforestation from 1990 to 2020.



Naturally regenerating forests represent **93%** of the world's forested area (3.75 billion hectares)



Planted forests represent **7%** of the world's forested area: (294 million hectares)

700Mha of forest land belongs to legally established protected areas } **18%** of the total forested area

Expansion of farming lies behind **90%** of deforestation worldwide



186Mha of forests around the world are given over to social services such as:

- Recreation
- Tourism
- Educational research
- Conservation of cultural and spiritual sites

Forests are a habitat for:

- 80%** of amphibian species
- 75%** of bird species
- 68%** of mammal species

424Mha of forests have been designated mainly for biodiversity conservation

398Mha of forests have been designated for soil and water protection

Forests contain total carbon stocks of **662MMt**

Despite a continuous reduction in area, forests **absorbed more carbon** than they emitted from **2011 to 2020**, due to **reforestation** and improved forest management

Forest carbon
Most forest carbon is found

- 45%** Organic matter in soil
- 44%** Living biomass Power
- 11%** Dead wood and waste

Unless additional **steps are taken**, it is estimated that, between **2016 and 2050**, **289Mha** of land will be deforested in the tropics, resulting in emissions of **169GtCO₂e**

It is estimated that **restoration of degraded land through forestation and reforestation** could remove between **0.9 and 1.5 GtCO₂e** from the atmosphere each year from **2020 to 2050**.

It is estimated that more than **half the world's gross domestic product** (84.4 billion dollars in 2020) is moderately dependent (31 billion dollars a year) or highly dependent (13 billion dollars a year) on ecosystem services, including those provided by forests

The wealth represented by certain forest ecosystem services:

- Recreation
- Game
- Habitat
- Non-wood forestry products
- Water service

is estimated at **7,5 billion \$** = **9%** of global gross domestic product

It is estimated that approximately **33 million** people - 1% of global employment - work directly in the forestry sector

It is estimated that **1/3** of the world's population depends on wood and other traditional fuels for cooking

It is estimated that between **3,5 billion and 5,76 billion** people use non-wood forestry products for their own use or to support their livelihood.

It is estimated that **4,17 billion people** (95% of all people outside urban areas) live within **5 km of a forest**

3,27 billion live within **1 km** of a forest

(Fontes: The State of the World's Forests 2022, FAO; Global Forest Resources Assessment 2020, FAO)

Forests: a crucial resource

They're an environmental and economic asset. They provide jobs and anchor rural communities. They're a national success story and central to our identity, our history and quality of life. Portugal has deep roots in the forest. And so does the future. Now that development has to be aligned with climate targets, Portugal's forests are again proving their worth and bringing out people's talents.

Forests dominate the Portuguese landscape

Covering more than three million hectares, forests are the largest form of land use in Portugal, corresponding to 36% of its territory, according to figures from the last National Forest Inventory (IFNG), conducted by the Institute of Nature Conservation and Forests (ICNF), launched in 2019, with figures relating to 2015. The Map of Land Use and Occupation in Mainland Portugal, with data from 2018 (COS 2018), produced by the country's land management authorities, shows that forests cover 39% of the land mass.

Woodlands on the Portuguese mainland consist mostly of indigenous species (72%), which can be divided into four main groups: pines (maritime pine and umbrella pine), evergreens (montado - cork and holm oak savannas), deciduous trees (oak, chestnut and others) and industrial broadleaf species (eucalyptus).

In Portugal, as in the rest of Europe, little remains of the original forests, untouched by man. According to figures from the Global Forest Resources Assessment (FRA 2020), only around 0.66% of woodlands in Portugal consists of native forest.

Planting has been crucial to the growth of the country's forested area. In the late nineteenth century, only around 7% of Portugal was forested. Thanks to private enterprise, the work of the forestry authorities in planting trees on dunes and uplands (predominantly maritime pine), careful tending of the montado, or cork oak savannas (for cork and cattle) and, from the mid-twentieth century onwards, the use of eucalyptus and pine for manufacturing paper pulp, the country's forests have grown from around 640 thousand hectares in 1874 to over 3 million hectares today.

In terms of ownership, Portugal differs from most other European countries, as can be seen in figures from the ICNF: 84.2% of woodlands in Portugal are privately owned, 13.8% are on communal land and only 2% on state-owned land.

In addition, smallholdings predominate and membership of forest owners' associations is low. And although the lack of a nationwide forest survey means that the precise number of owners is unknown, the total is estimated at around four hundred thousand. ●

Economic wealth with roots throughout the country

From manufacturing to silviculture, planted forests are the foundation of a value chain that generates wealth, exports with a high proportion of national value added and jobs all over the country, including rural areas.

Goods and services produced the main forestry sectors - pine, cork oak and eucalyptus - have an extremely significant impact on Portugal's national accounts. The latest figures from the National Office of Statistics (INE) on the contribution of forest based industries speak for themselves: turnover of 13.5 billion euros in 2022, representing 5.6% of Gross Domestic Product.

To arrive at an even fuller picture of the economic importance of forestry, we need to add the turnover from silviculture and forestry, which in the same year was in excess of 1.1 billion euros, equivalent to 0.48% of GDP. All in all, the sector represents 6.07% of GDP and aggregate turnover of more than 14.7 billion euros.

This is a sector which not only generates sales, but also features significant Gross Value Added (GVA), i.e. the value of industrial

operations, less production costs. In 2022, according to the same source, companies operating in the forestry sector accounted for Gross Value Added of more than 3.6 billion euros, 1.6% of the country's GVA. As might be expected, manufacturing accounted for the largest slice of this indicator, with GVA of more than 3.3 billion euros.

Forestry sector provides 9% of total Portuguese exports

In 2022, according to the INE, the sector's exports were worth more than 7 billion euros, corresponding to 9% of the country's total. For the second year running, foreign sales of forestry products (which includes materials sourced from forests and industrial products derived from them) increased in value, up by 25.8% on 2021.

The INE figures actually point to a record: in 2022, the trade balance surplus was 3.3 billion euros, up by

20.5% on 2021.

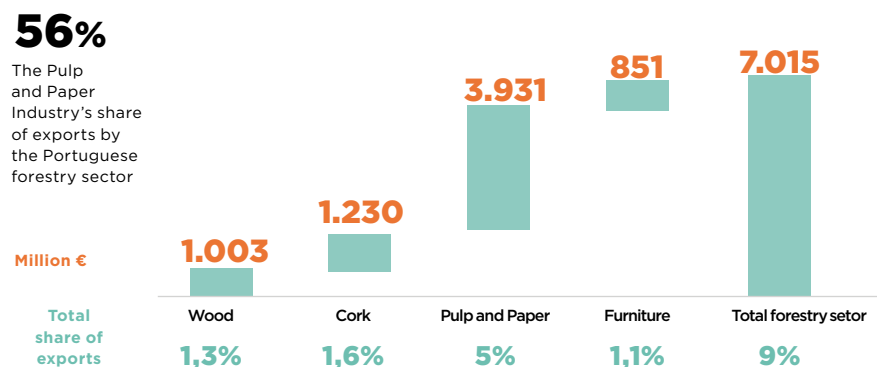
The bulk of foreign sales are by manufacturers in the sectors, which accounted for more than 6.9 billion euros, corresponding to 98% of the total. The remaining 2%, more than 156.6 million euros, came from sales of materials sourced from forests (wood, cork and others).

The Pulp and Paper sector led the way, with close to 4 billion euros, representing 56% of all forest-based exports and approximately 5% of the country's total exports.

The trade balance for pulp and paper/cardboard products has shown a surplus for decades, (1.47 billion € in 2022), with a foreign trade coverage rate of 220%, according to Biond, the Association of Forest-based Bioindustries. Figures from the INE also show that the sector has the country's second largest trade surplus, outperformed only by "minerals and ores".

All in all, the forestry sector represents 6.07% of GDP.

Forestry accounted for 9% of exports in 2022

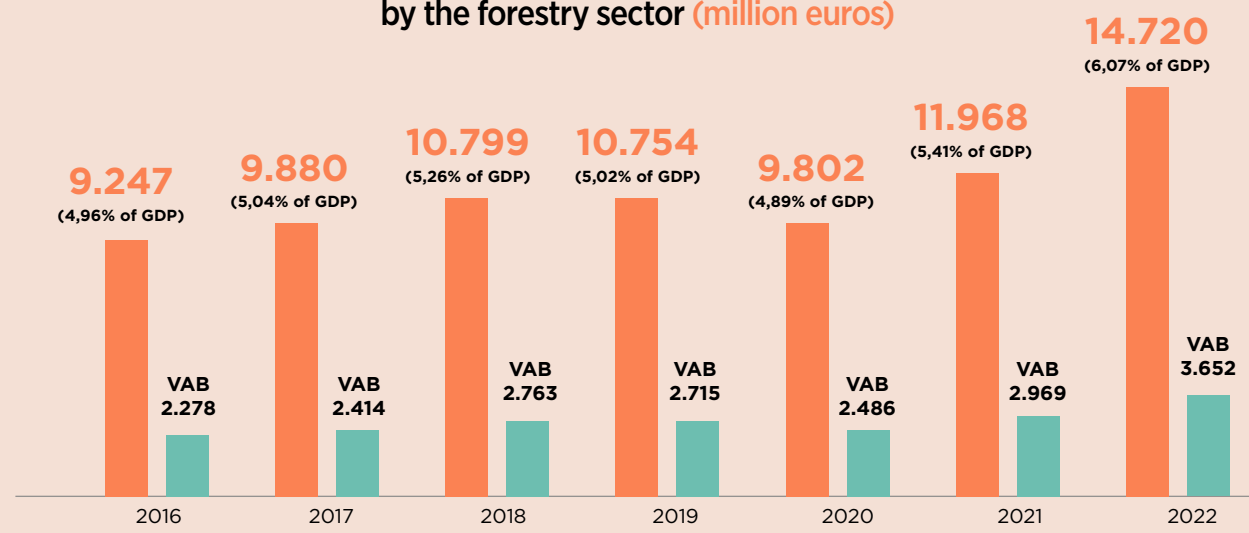


In 2022, turnover from forestry and forest operations exceeded 1.1 billion euros.



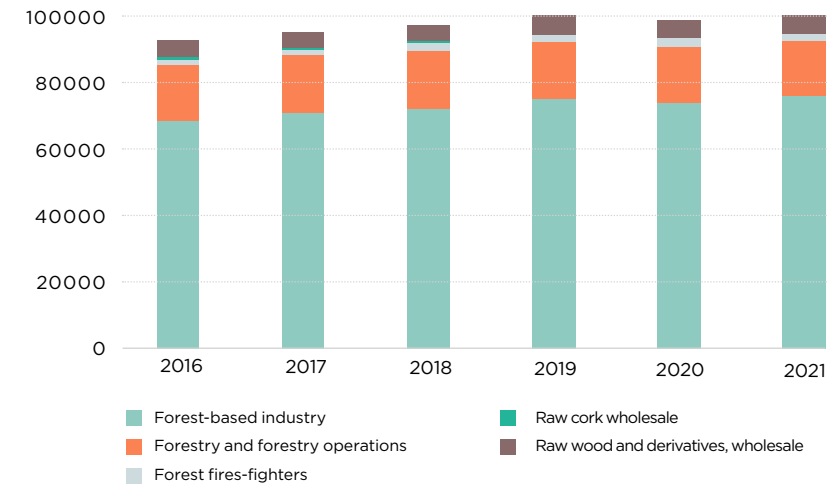
The creation of jobs in different regions is one of the fundamental features of the forestry industry.

Turnover and Gross Value Added generated by the forestry sector (million euros)



Source: INE - Turnover and Gross Value Added (€) of companies by economic activity (Sub-class - SIC Rev. 3) and size of workforce, annual. Figure includes forest-based industry and forestry

Employment in forestry sector, by subsectors, 2016-2021



100.000 direct jobs

400.000 landowners

19.500 companies

9% of Portuguese exports

6% of Gross Domestic Product

36% of all land in Portugal

72% Native species

(Sources: DGAE; INE; IFN6, ICNF)

Despite this robust health, the Portuguese forestry sector has to contend with a growing shortage of raw materials, which has led to an increase in imports. In 2022, imports of forest raw materials cost the sector 592 million euros. The pulp and paper sector has been hardest hit by the need to procure supplies from abroad, and was forced to import more than 2.9 million tons, at a cost of 327 million euros. Imports of wood have grown continuously in recent years: in 2018 they stood at around 1.8 million tons.

Employment to correct regional imbalances

The creation of jobs in different regions is one of the fundamental features of the forestry industry in all sectors - primary, secondary and tertiary. In 2021, according to INE figures, the industry employed more than 100 thousand people in more than 19.5 thousand companies, in settings that range from silviculture to manufacturing to marketing. From a national perspective, these figures show us that employment created by the sector

represents 2.31% of all jobs in Portugal. Figures from the Directorate-General for Economic Activities (DGAE) for 2021 confirm that the industrial sector, as might be expected, accounts for the bulk of employment; forest-based industries employed 77,918 people, representing more close to 8% of the total for the manufacturing sector and around 1.84% of the total workforce of Portuguese companies that year. Consisting overwhelmingly of small companies (even in manufacturing, where around 86% have a workforce of less than ten), the economic fabric of the forestry sector is spread well around the country, with 80% of companies located in several districts of the northern and central regions. These figures are also in line with one of the most notable trends of the forest economy around the world: this is one of the few sectors in which communities live in the main production areas. According to the WWF (World Wide Fund for Nature), around 300 people around the planet live in forests, and more than a billion depend on forests for their livelihood. ●

Bioeconomy: green industrialisation

It's a twofold opportunity and also a challenge: at the same time as the world is looking for an alternative to the fossil paradigm, Europe faces the need to redevelop its industry. The time is ripe for the forest-based bioeconomy. And Portugal is ideally placed to prosper in this new development model.



The European Union (EU) launched its first bioeconomy strategy in 2012, called “Innovation for Sustainable Growth: A Bioeconomy for Europe”. This was revised in 2018, adopting the priorities of expansion and growth in scale of nature-based sectors, rapid implementation of local bioeconomies throughout Europe, and appraisal of the limits of the bioeconomy, in particular the sustainable supply of biological resources and consumer acceptance of bioprocesses and bioproducts. Circularity and sustainability are two consistent threads in his strategy. The EU calculates that, in 2019, the European bioeconomy was already worth 2.4 billion euros, accounting for 18 million jobs, in farming, forestry, fisheries, food and pulp and paper production, as well as in the chemical, biotechnology and energy industries, according to the EU Bioeconomy Progress Report, of May 2022. In Portugal, the Action Plan for the Sustainable Bioeconomy was published in 2021, for a time horizon of 2025, asserting that “the Bioeconomy is the only economic

model able to respond to the challenges facing Mankind.” This is a national plan based on five key areas of intervention, including promotion of research, development and innovation, and fostering top-class national scientific and technological capability. The national goals set by this strategy also include incentives for sustainable production and smart use of regionally-based biological resources, as well as development of a circular and sustainable bioindustry, founded on innovation in the value chain and in processes.

Forests at the centre of the bioeconomy

Planted and well-managed forests have therefore found themselves at the forefront of solutions to the challenges of climate change and the transition from a linear, fossil-based economy to a new circular bioeconomy model, in harmony with nature. Forest-based products are natural, renewable, recyclable and biodegradable, offering an alternative to those derived from petrochemicals, with benefits in terms of greenhouse gas emissions and efficient use of resources. In Portugal, the pulp and paper

industry, based on these planted and actively managed forests, is particularly well placed to respond to the challenges of a sustainable planet: its main raw material is a renewable resource (wood and ligno-cellulosic biomass), as an industry it tends to be neutral in terms of carbon emissions, and its products - recyclable and biodegradable - are examples of best practice in a circular economy. In this context, pulp and paper mills are evolving towards true biorefineries, in which wood and forestry biomass, as well as industrial and forestry by-products, are converted, through energy-efficient and environmentally friendly processes, into cellulose fibre, paper materials, bioenergy, biofuels and bioproducts that are alternatives or equivalent to products derived from petrochemicals, making this sector a pillar of the modern circular bioeconomy. By 2050, according to figures from CEPI (Confederation of European Paper Industries), the GVA of the pulp and paper sector is expected to increase by approximately 50%, and 40% of this will be through the new bioproducts now being developed. ●

The pulp and paper industry, based on planted and actively managed forests, is well placed to respond to the challenges of a sustainable planet

Eucalyptus: crucial to the sector and to Portugal

In terms of turnover, exports with a high level of value added and also jobs, the eucalyptus sector creates outstanding value throughout Portugal's social and economic fabric.

A study of the sector's socio-economic impact, conducted by Biond (Association of Forest-based Bioindustries), has provided a snapshot of the sector, with figures for 2022. The report has highlighted the proportion of national value added (NVA) in exports of forest-based products, reflected in an NVA coefficient of over 80%, resulting from efficient use of raw materials produced in the country, in conjunction with manpower.

The scale of national value added is even clearer when compared with other industries, such as machinery and apparatus (47%), chemicals and petrochemicals (43%), metals and metal products (51%) and water and energy (63%).

By way of example, The Navigator Company, whilst ranking as the country's third largest exporter, tops the table for NVA, due to the local value incorporated. Of its close to 7,500 suppliers, 73% are Portuguese, according to company figures for 2023.

When we look at turnover, the figures are also eye-catching. According to the same report from Biond, eucalyptus sector sales amounted to 4,008 million euros in 2022 (i.e. 1.7% of GDP), of which more than 4,000 million were export sales. Once again, an outstanding contribution to the economy: the eucalyptus sector accounts for around 5% of total exports and approximately 56% of all forestry exports.

The top products are paper and cardboard, with Portugal ranking as Europe's largest manufacturer of uncoated (UWF) paper and cardboard, with 20.9%. Indeed, Portugal is the world leader in the premium printing and writing paper segment, thanks to the Navigator brand, produced in the country by The Navigator Company.

In terms of employment, Biond also reports that the eucalyptus sector generates around 5,500 direct skilled jobs (70% with a qualification level equivalent to completed secondary education or higher) and more than

80,000 jobs in indirect and induced employment in the Portuguese economy.

According to the same source, the sector pays more than 2.5 billion euros to the State each year in taxes and social security contributions. Businesses operating in the eucalyptus sector are responsible for the direct transfer of 325 million euros to the rural economy of the 18 districts of mainland Portugal, as a result of purchases of wood from suppliers and landowners, rentals for 2,780 landowners who let their land, and the contracting of forestry and logistical services and operations from more than 200 forestry service companies, among others.

As well as along the value chain, there is an array of interdependent industries centred on the sector, such as suppliers of plants and fertilisers, equipment, forestry and industrial services, civil construction, furniture-building, the pharmaceutical and agro-food industries, and others. ●

Eucalyptus sector sales accounted for 1.7% of GDP in 2022.



A strong ally in environmental protection

The forest is the Earth's prime system for producing oxygen and removing carbon from the atmosphere, playing a fundamental role in controlling climate change. It is also integral to the water and soil cycles and represents some of the planet's most biodiverse ecosystems.

Although the three pillars of development - economy, society, and the environment - are not actually a hierarchy, the environmental importance of forests has a bearing on practically all the functions performed by woodlands. Without forgetting the products that forests yield and the economic and social needs that these meet, good forestry management should prioritise land use systems that are geared to conserving biodiversity, water, and soil.

The forest produces

Although forestry production is clearly a socio-economic factor, its environmental impact is clear when we think of the production of biomass for energy. One of the key features of Portugal's energy policy is the use of forestry biomass left over by other industrial sectors. This boosts the country's self-sufficiency in energy and increases the energy output from renewable sources.

Biomass, which results from preparing wood for industrial use (waste such as bark and off-cuts) and from the lignin dissolved from the wood (black liquor), is an eco-friendly fuel in comparison with fossil fuels. The concept also includes waste from forest maintenance operations, which are themselves important for preventing fires and preserving ecosystems, in a valuable contribution to the environment.

The forest protects

The idea of protection ties in again with the environment. The forest protects the hydrographical network, through riverside vegetation, which holds the banks of water courses in place and guarantees their quality. It also defends the soil against water erosion and floods, cushioning against severe events, at the same time as permitting water retention and seepage. Forests also protect against wind erosion, holding sand in place and helping to produce the soil, transforming larger particles into smaller ones. The decomposition of organic matter, which is incorporated in the land, produces good soil, helping in the recovery of degraded land.

The micro-climatic protection afforded by forests can be seen in curtains of trees that shelter agricultural crops, pasture land, and even human constructions from strong winds, salt deposits from the sea, and bodies of cold air. Forests are also able to absorb mist, a vital function in regions where a substantial part of the water resources are obtained precisely from this source.

The forest conserves

Another area where woodlands serve an important function is in the preservation of biological resources and major geological features, which are themselves valuable, non-renewable resources.

These resources include classified habitats and protected species of flora and fauna. The natural habitats to be found in Portugal are of great importance, given the outlying location of Portugal on the European mainland and the geographical location of the islands. Species of flora have been protected in Portugal since 1938, when trees and areas of woodland and brushland were first classified as being "of public interest". The first list of protected animals dates from 1968. Portugal's woodlands are home today to a large number of species with special protected status, such as the lynx, Bonelli's eagle, and the gold-striped salamander.

Fighting climate change

Given the magnitude of the environmental threats we face, forestry issues are increasingly addressed from a global perspective. Portugal belongs to Europe and takes part in international talks, reflecting the fact that the benefits, commitments, and challenges associated with forests are common to all, and responsibilities are shared. The European Union has adopted the target of achieving neutrality in CO2 emissions in 2050, and the Portuguese government has established a plan for achieving this objective. Globally, the forest plays an important role in these



Preserving biodiversity is part of the function of forest conservation.

challenges, as the world's prime carbon sink.

Forests filter particles and atmospheric pollution, especially in densely urban or industrial areas, and retain CO2. In other words, as well as contributing to the air we breathe, through photosynthesis, woodlands are also our best system for removing CO2 from the atmosphere: due to their great capacity for producing vegetable biomass, Portugal's woodlands are highly efficient in sequestering and storing carbon, thereby compensating for some of the emissions from human activities.

In Portugal, the LULUCF (Land Use, Land Use Change and Forestry) sector has functioned as a carbon sink most years since 1990, according to data from the 2023 National Inventory Report (NIR), in which Portuguese indicators are reported to the European authorities.

In 2021, greenhouse gas (GEE) emissions in Portugal totalled 56.5 Mt CO2 eq, but this figure is brought down to 50.5 Mt CO2 eq if we consider the removal of 6 Mt CO2 eq by the LULUCF sector. From 1990 to 2021, woodlands made a positive contribution to removing greenhouse gases in 27 of the 32 years analysed. In years when large fires occurred, such as in 2003, 2005 and 2017, forests ended up generating more emissions than they were able to remove from the atmosphere.

Woodlands were responsible for **sequestering** an annual average of 5.58 Mt CO2 eq between 1990 and 2021. This figure is reduced to an average of 2.84 Mt CO2 eq (net emissions) if we consider other sources of emissions related to forests, mainly those associated with fires.

This proves that, as regards influence on the environment, the forest is a circle: it helps to care for the environment, but it needs to be managed sustainably and on an environmentally sustainable basis in order to be able to perform this important function. ●

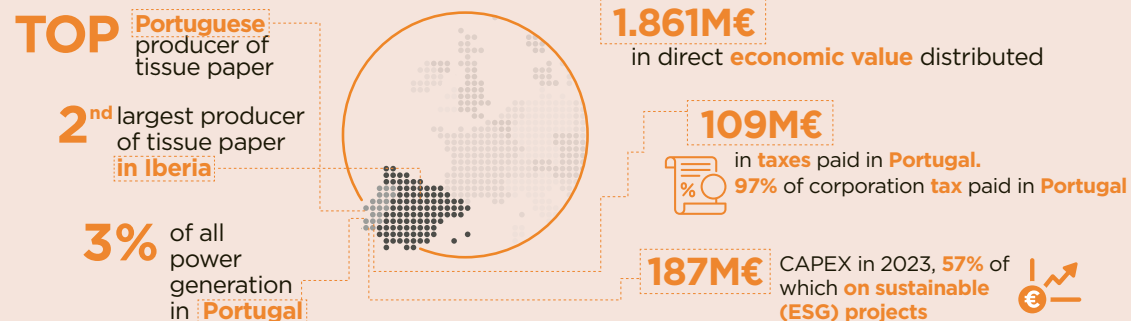
Eucalyptus globulus is especially effective at sequestering carbon: this species sequesters around 11.3 tons of CO2 per hectare per year, more than any other species in Portugal's forests. The same area of globulus sequesters three times more carbon than maritime pine and seven times more than cork oaks.

The Navigator Company's positive impact

A commitment to creating sustainable value is built into The Navigator Company's corporate purpose. As a result, the Company's positive impact reaches across the three pillars of sustainability: economic, social, and environmental.

ECONOMIC AND SOCIAL IMPACT: ON WEALTH CREATION

As a top player in wealth generation in Portugal, and in its contribution to the country's economy, Navigator has a direct impact on the lives of **thousands of people** all along the value chain.



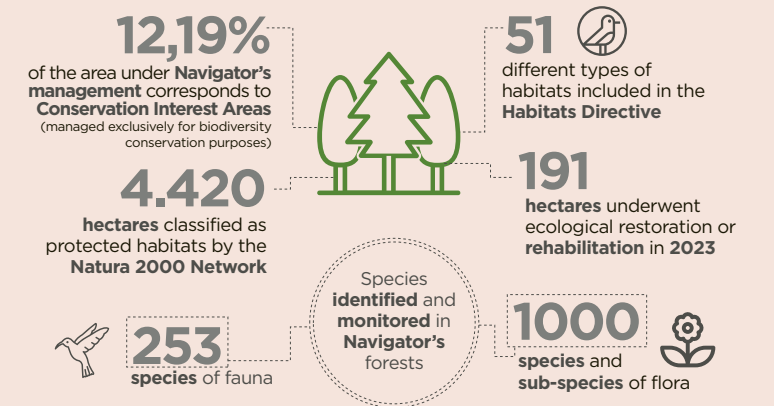
SOCIAL AND ENVIRONMENTAL IMPACT: ON RURAL AREAS AND FORESTS

Navigator is a **driving force** of the rural economy, helping to develop the regions where it operates. It has developed relationships with growers based on **sharing knowledge** and education about the values of **sustainable forestry management** and certification, with an iron-clad commitment to improving and protecting forests.



BIODIVERSITY CONSERVATION

Navigator has adopted a conservation strategy that involves implementing a series of management measures, including monitoring species, protecting water courses and maintaining buffer areas for protecting valuable habitats. In addition, it delays forest operations and maintenance work, so as not to coincide with the nesting season of certain birds

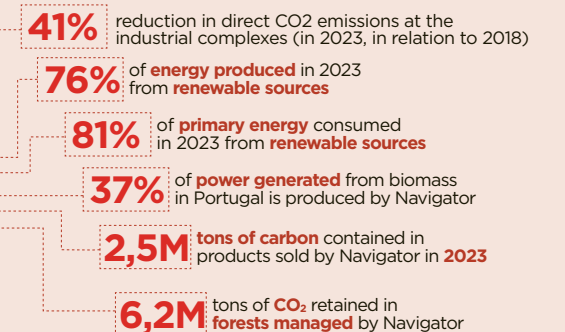


DECARBONISATION ROADMAP AND THE FUTURE OF THE PLANET

340M€ investment in **decarbonising industrial complexes** (over the period 2018-2035)

In 2023 Navigator brought forward its interim emissions targets by **three years**, meaning it will now achieve in 2026 the goals initially set for 2029

Em 2026 **direct emissions** of fossil CO2 will be around **60% lower** than in 2018



Eucalyptus globulus is highly effective in sequestering CO2: each year, per hectare, this species sequesters around 11.3 tons of CO2, the **highest annual sequestration figures for any species found in Portugal's forests** - more than **seven times** higher than for cork oaks and **three times** higher than maritime pine

A NEW GENERATION OF BIOPRODUCTS

Navigator is involved in **promising R&D projects** to generate a broader range of renewable, **recyclable, and biodegradable bioproducts**, made from cellulose, able to **substitute fossil-based products**.

The **"From Fossil to Forest"** Agenda, geared toward developing sustainable packaging products to substitute fossil plastic, will take an important step forward in 2024: start-up of an innovative industrial unit for **integrated production of molded cellulose parts**, from *Eucalyptus globulus* pulp, for use in the food packaging segment.

The "From Fossil to Forest" Agenda won a Transformation **Award in 2023** from Deloitte Portugal, in the category for "Transformation and innovation projects with market impact."

In 2023, the gKRAFT packaging papers range won the **National Innovation Prize**.

From
Portuguese
forests to the

World

Portugal has consolidated a leading international position in the paper pulp, paper, and cork sectors, demonstrating a unique combination of tradition, innovation, and quality.

Portugal's capacity for innovation and production is inversely proportionate to the size of the country. It has the creativity, the knowledge, and the willpower. And it has superb raw materials, sourced from forests occupying more than a third of the land mass and supplying essential natural resources for the country's prosperity.

These forests, with their unique species diversity, lie at the heart of Portugal's industry, feeding it with premium quality materials, enabling the country to stand out on international markets. But Portugal's success story is based on more than just numbers.

Each gramme of pulp, each sheet of paper, each cork stopper that leaves its factories is more than a product - it expresses the country's dedication and skill, which echo round the whole world.

And when the country looks to the future, it knows the challenges are huge, but its determination is even greater. With a commitment renewed by sustainability and innovation, Portugal will continue to lead the way, taking Portugal's name even further. Because, armed with the highest standards, borders are no barrier to Portuguese industry. On the following pages, remind yourself of some of Portugal's emblematic products, supplied worldwide from its forests. ●

Forest-based products



Printing and writing paper

It's one of the most commonly recycled products in Europe. And even when not recycled, it's biodegradable and compostable. The Navigator Company's paper comes from forests that are actively managed and 100% certified. It uses fibre from eucalyptus globulus, meaning that more paper is produced from less wood, and using less chemicals. It can also be recycled more times. Navigator is Europe's leading manufacturer of UWF printing and writing paper and the sixth largest in the world.



Packaging paper

The gKRAFT brand spearheaded The Navigator Company's move into the packaging sector, in 2021. A response to the urgent need to substitute fossil-based plastics, above all single-use plastics, so as to tackle the climate and environmental crises. The concept behind gKRAFT, "From Fossil to Forest", encapsulates the idea of a shift to a new packaging paradigm. As well as the reduction in CO2 emissions it makes possible, by substituting fossil materials, the use of Eucalyptus globulus raw materials means more packaging can be made from less wood. It's also more compostable and can be recycled more times than other fibres.



Tissue paper

When Navigator moved into the tissue market in 2015, it invested heavily in scientific research, which has yielded disruptive and highly innovative products. A gamble that has paid off. This year, Amoos Calorie Control kitchen roll won the "Five Stars" award, based on levels of consumer satisfaction. This innovative kitchen roll features tiny air pockets, making it more effective in absorbing fats from freshly fried foods. The Amoos had already won the "Five Stars" award in 2022, with its Amoos Aquactive kitchen roll, and in 2023, with Amoos Air Sense toilet paper.



Moulded cellulose

A new range of molded cellulose packaging is due for launch in 2024 in the food service and food packaging market. This is the first time anywhere in the world that packaging in this material will be produced from eucalyptus fibre. Bearing The Navigator Company's gKRAFT brand, this new Bioshield range is the latest in the Company's ongoing response to the need to replace single-use plastics, from fossil sources, that currently dominate the packaging sector. The new molded cellulose solutions feature barrier properties and comply with all safety requirements for food contact.



Cellulose in the pharmaceutical industry and medicine

New and important uses for cellulose have emerged in pharmaceuticals in recent years, such as a coating for tablets, a thickener, or a binder. These applications are joined by others in regenerative medicine: biosensors, and moulds for cell growth and tissue regeneration are some examples of how cellulose is being used.



A natural fabric

Lyocell is a fabric made from wood pulp, normally eucalyptus, sourced from responsibly managed forests, planted specifically for production purposes. Countless fashion and household linen brands around the world are opting for lyocell for their collections because its environmental impact is smaller than for traditional textiles.



A new generation of biofuels

A new generation of biofuels is being developed from waste forestry biomass (materials left over from forestry operations) and by-products from the manufacture of eucalyptus pulp. The Navigator Company has invested in cellulose sugars and converting them into bioethanol for use in advanced biofuels, with the potential to substitute fuels derived from petrochemicals. Production will use 100% energy-efficient and environmentally friendly processes.



Cork stoppers

Patented in 1889 by the Englishman Dan Rylands, from Barnsley, cork stoppers had previously been used by the monk Dom Pérignon, in 1720, for sealing champagne bottles. A solution that was later adapted to wine bottles - previously, wine had to be drunk fresh, as there was no way of conserving it. Cork stoppers have evolved constantly over time, adapting to different needs and uses. And they are still the main cork-based product exported from Portugal.



Surfboards

Cork reached the surf world through the Corecork technology, developed by Corticeira Amorim: boards made of strong and relatively thin sheets, which are fixed to thicker and lighter materials making up the core. The brainchild of researchers and designers, surfboards incorporating cork have received inputs from the surf star, Garrett McNamara. One of the main features of these boards is their superb impact absorption, extending their useful life. They also offer excellent compressibility, making them more comfortable for surfers, as well as a core that won't rot in water, greater strength and flexibility, and eco-friendly design. "Cork stringers are set to revolutionise surfing", McNamara has said.



Vehicle interiors

The Mini Strip is a version of the iconic care based on the ideals of "simplicity, transparency and sustainability". One of the materials used in the car's interior was recycled cork: it covers the entire dashboard, the sun visor, and also the top of the doors, replacing the plastic normally used in these car parts. The cork used was supplied by Amorim Cork Composites, a unit of Corticeira Amorim that develops products, solutions, and applications for the automobile and aerospace industries, sport, energy and design.



Aerospace industry

Corticeira Amorim is a lead technology partner for the supply of insulation systems to NASA and the European Space Agency (ESA). Cork was first used in spacecraft and rockets for the first manned mission to the moon, Apollo XI. It has also been used in the Titan, Delta, Mars Rovers, and Atlantis programmes. In the ESA programme, cork solutions are used in the thermal and anti-vibration shields for Ariane 5 and the Vega rocket. Corticeira Amorim also led a 100% Portuguese consortium for the development of a new atmospheric reentry capsule for the European Space Agency's Mars exploration programme, which will bring back samples from the planet in 2026.. ●

Sustainable care for Portugal's forests

Portuguese woodlands play a vital role in social well-being and economic development, as well as in the environment. Of course, success in each of these areas is reliant on success in the others.

Altri manages a significant proportion of Portuguese forests, and as such has an added responsibility for their maintenance and preservation. The 92 thousand hectares under its direct management are 100% certified, including 76 thousand hectares of production forests planted with eucalyptus, 10 thousand hectares of conservation woodlands, 4 thousand hectares of cork oak, and 3 thousand hectares of maritime pine, as well as areas of pasture land, riverside areas, surface waters, and other social and operational facilities.

Our goals and purpose have led Altri to step up investment in its forest holdings over the past six years, expanding them by approximately 10 thousand hectares. This represents a commitment to the future because, as well as seeing forestry production as part of our core business, we firmly believe we have a duty and a social responsibility to contribute to the development of more resilient and sustainable forests. We have invested not only in acquiring and renting woodlands, but also in training forestry operators and service providers in fire prevention, in research into the species best adapted to climate change, in combating pests and controlling plant health, and in creating areas of significant conservation and biodiversity interest, which everyone can enjoy.

We are building stronger ties with communities and local actors, through complementary activities with the company. We have established

partnerships with beekeepers, shepherds, and mushroom gatherers, keeping an inventory of these and other activities of economic, social, and recreational interest, as part of our efforts to encourage transparency and a mutually beneficial relationship, in over 160 municipalities where Altri has operations. We are also working to assess and record our carbon footprint, seeking opportunities for cutting emissions and opportunities to work with our service providers and suppliers, and for communicating transparently with our customers. In partnership with universities and research institutes, we have stepped up and raised the profile of our strategy for promoting and restoring biodiversity, Altri Diversity. This is a wide-spectrum strategy that involves a variety of partners. It has grown out of the concept of environmental citizenship and alignment with the aims of Act4Nature, in which we have been involved.

All these activities are leveraged by Altri's forest-related turnover in rural areas, which is in excess of 130 million euros a year. As well as this direct effect, we can point to the knock-on effect of this investment on the local economy, generating jobs and creating value in a number of industrial and services sectors, especially in inland regions, which often face significant problems of rural flight and abandoned land.

In a company like Altri, these new collaborative dynamics can also help to generate bold new ideas, pointing us in new directions and preparing for the future. By learning more about the problems and opportunities, and seeing them from different angles, operations can be planned to prepare for the challenges ahead.

At Altri, we have identified four strategic action areas, including investment in people, the highest

operational standards and technological innovation, a focus on sustainability as a factor for competitiveness, and also developing and improving forests. In this last area, the company has developed and is using new predictive management models based on the physiological responses of eucalyptus, the use of superabsorbent polymers in the planting of new forests, the use of hybrid machinery for felling and handling wood, the use of industrial by-products and organic sludges for producing organo-mineral fertilisers and green bioproducts, and also increased efficiency in using all waste resulting from wood processing. Also concerning natural resources, we focus on continuous improvement in specific consumption of wood, water, and energy in the production process, with obvious benefits both in terms of responsible use of these resources and in economic terms.

It is impossible to speak of the forest without referring to the importance of the associated bioindustries. We are proud of our track record in this area, with constant improvements to our industry capacity and processing cellulose fibres that bring improvements to people's quality of life, in the areas of health and hygiene, textiles, consumer goods, and industrial specialities, often making it possible to substitute fossil-based products.

Forestry and its different sectors should be a source of national pride. What motivates us is our commitment to the future, contributing renewably-sourced products that society needs and appreciates. This enables us to create wealth, add value to natural resources and invest in the people who work with us, all for the sake of a more renewable world. ●

by José Soares de Pina, CEO of Altri SGPS



Portugal urgently needs a forestry plan

The cork oak is one of the most emblematic species in Portugal's woodlands and is central to the country's culture and economy.

These trees are found across several countries in southern Europe and northern Africa, with half of the total area in the south of the Iberian Peninsula. In mainland Portugal, cork oaks occupy 720 thousand hectares and account for 22.3% of all woodlands. The country produces 50% of the world's cork.

Confirming the cork oak's economic, cultural, and symbolic importance, it was unanimously chosen as Portugal's national tree by the Assembly of the Republic in 2011.

Cork oak savannas, known as montado, are important to the economy, not just because of the cork. These woodlands combine forestry operations with farming, grazing, and hunting, and the related ecosystem services serve an essential function in the present and future sustainability of the environment and the Portuguese economy.

The vital ecosystem services provided by cork oak woodlands include: (1) Carbon sequestration, helping to mitigate climate change. It is estimated that, under optimum forest management conditions, 1 t of cork captures 73 t of CO₂; (2) Regulation of the water balance, with regulation of the water cycle helping to maintain water tables and prevent droughts and floods; (3) Reduction of fire risk, using the fire resistant properties of cork to protect the tree; (4) Soil conservation, preventing erosion because of the cork oak's deep roots and maintaining fertility through the undergrowth; (5) Functional biodiversity, providing shelter for a huge wealth of

biodiversity, including plants, animals and microorganisms, classified by the UN as one of the world's 36 top biodiversity hotspots; (6) Scenic value of the landscape, contributing to the beauty of the countryside and the quality of life for local communities. An estimated 100,000 people depend on cork oak woodlands for their livelihood. If they are to be sustainable in the future, it is vital to recognise and value cork oak woodlands as an integral part of our natural heritage, finding ways for society and the markets to remunerate the ecosystem services provided.

The growth in Portuguese exports of cork in recent years and the prospects for future growth mean that long-term thinking is needed to increase cork output, ensuring that the business is sustainable. This is the responsibility of all players in the sector.

Corticeira Amorim has embraced its role as the sector's leader.

We are at stage five of our corporate development: "Forest know-how and Cork Production", where being a leading player in forestry and securing complete expertise in the cork segment has become Corticeira Amorim's strategic goal.

To achieve this, Corticeira Amorim is implementing a Forestry Intervention Plan based on three action areas: (1) Research, using genetic selection to find plants resistant to climate change, pests and diseases; (2) Intervention, applying a new forestry model to new planted areas, using new processes and innovative technologies, where densification can enable forestry producers become more competitive, and (3) Induction, by sharing knowledge with forestry producers and providing technical support, so as to encourage the planting of new areas.

The ambition for these new plantations is 50,000 hectares, with densities of 400 trees per hectare, in a time horizon of 10 years. At the same time, we aim to take an active role in advising and implementing best forestry management practices in the existing 720 thousand hectares of cork oak woodlands, to ensure that current levels of cork production are sustained. These two action areas together will guarantee levels of cork production that accommodate future growth in all applications and ensure the long-term sustainability of the business and the sector.

Creating value for the sector is Corticeira Amorim's constant goal. To this end, we continue to develop applications that open up new and more profitable paradigms for adding value to cork. It is also important to introduce technology and innovative processes in cork harvesting operations. Lastly, the sector should work to adapt the business model for cork oak woodlands, by adding new sources of income linked to remuneration of ecosystem services. In a country where the international commitment made in the Roadmap to Carbon Neutrality should serve to leverage a national strategy, and where forests play an unrivalled role in the economy and society, there is an urgent need for a comprehensive forestry plan, addressing the different species and their potential for complementarity, and seeking to promote regional development on a planned, orderly and cohesive basis. Only then will our forests cease to be viewed merely as the scene of tragic fires and instead fulfil their true role as a distinctive national asset. ●

by António Rios de Amorim, CEO of Corticeira Amorim

Knowledge as understanding

The Navigator Company has embraced sustainable development with an unwavering belief in the values that have underpinned the Company's growth and success over its history of seven decades - building on people's skills and talent, innovation, and expertise. For more than 70 years, we have nurtured the role of planted and well-managed forests in creating environmental, social, and economic value, as a core feature of our corporate culture. Our operations result in natural and sustainable products, which are recyclable and biodegradable, obtained in a production cycle that helps to sequester carbon, produce oxygen, protect biodiversity, promote soil formation, regulate the water cycle, and contribute to territorial cohesion. In short, since the Company was founded in 1953, we have been faithful to the principles of what later, in 1987, in the Brundtland Report, was to be defined as "sustainability". This is a set of values that incorporates our Purpose, reflecting Navigator's commitment to people and the planet. It also envisages sharing not only our resources but also our know-how and experience, in the quest for a better future. We are extremely conscious of the importance of expertise and aware that sustainability - full, inclusive, and fair - will only be a lasting reality if it is rooted in an educated and well-informed society. These are the principles that led The Navigator Company to organise the Eucalyptus Forum, a pioneering initiative in Portugal, which sets out to improve literacy in Portuguese society concerning forestry matters and planted eucalyptus forests in particular. We're not doing this alone: we've brought together researchers, experts from forestry companies, representatives of academe, rural communities, local authorities, and NGOs, as well as opinion makers

and the media. This project entails the unprecedented task of collating, sharing, and encouraging debate on all the technical and scientific knowledge on eucalyptus forests. Around 120 people have been involved, including researchers, internal technical staff, and leading figures outside Navigator. But we haven't stopped there: for the first time, we've also commissioned an independent survey, conducted by a university institute (ISCTE), of public perceptions of eucalyptus, to find out what motivates our stakeholders concerning this species. We will share all this with society, starting at the first public session of the Eucalyptus Forum, to be held in the first half of 2024. We want to provide information and encourage open debate, based on science and facts, and not on myths and ideology. Because we can only understand things if we learn about them first. This need to raise awareness is made urgent by new, more sustainable models of development. In the shift from a linear economy based on fossil resources to a circular and climate-neutral bioeconomy founded on renewable resources, planted and well-managed forests have a central role, offering benefits such as CO₂ sequestration and production of oxygen, whilst producing biomass that can be converted into natural and sustainable bioproducts, both recyclable and biodegradable, as well as able to substitute many products obtained today from petrochemicals. In Portugal, planted forests of eucalyptus globulus are proving their worth as a source of raw material for a new generation of bioproducts, thanks to investment in scientific research which is opening the way to new cellulose applications, such as those that Navigator is launching on the market, including innovative and sustainable packaging solutions, helping to wean the economy off plastics. Navigator's research pipeline

also promises biofuels (bioethanol, biomethanol, and biomethane) and synthetic fuels (e-SAFs and e-methanol), derived from industrial by-products, with varied applications in sectors such as cosmetics and nutraceuticals.

This is a unique competitive advantage for Portugal! There are 900 known species in the Eucalyptus genus, but only around 10 are used to produce cellulose pulp around the world. Of this small group, the wood from *E. globulus*, the species we have planted in Portugal for close to two centuries, is regarded internationally as the best in quality and the most eco-efficient, because less wood and chemicals are needed per ton of pulp produced or fewer fibres are used per ton of paper. And when the paper has been used, it can be recycled two to six times more than with fibre from other species.

The temperate climate needed by globulus is a constraint of large-scale planting in most regions - in Europe, only in Portugal and part of Spain can it be cultivated with success.

In the market for cellulose pulps, eucalyptus fibres already account for around 45% of global consumption, and 75% if we consider only hardwood fibres, which are the fastest growing. Europe produces only 30% of its needs, and all its output comes from the Iberian Peninsula. The rest is imported from Latin America, with obvious negative impacts on the trade balance, not to mention the risks associated with long supply chains and the increased carbon footprint resulting from the emissions caused by long-distance transportation.

In Portugal, the political constraints on planting, resulting from ideological beliefs and party political manoeuvring, without any technical or scientific basis, have led to growing imports of eucalyptus timber, costing the country more than 300 M€/year. This is a raw material that could be produced locally, in planted and



by António Redondo, CEO of The Navigator Company

well-managed forests, helping to reduce the fire risk associated with abandoned land, and contributing to CO₂ sequestration and regulation of the water cycle. This would also boost yields from the country's forests, combating the exodus of people and businesses from the countryside, and adding to the prosperity of rural areas.

The cap on the production of raw material puts a brake on the development of the existing pulp and paper cluster, and also prevents the emergence of new and innovative clusters with the potential for significant value added, the feasibility of which we have been demonstrating, on the basis of planted eucalyptus globulus forests in Portugal.

Forest-based bioindustries such as pulp and paper, founded on planted eucalyptus forests, are an important agro-industrial sector for meeting the environmental targets set for the country. They also position Portugal at the forefront of European efforts to establish the bioeconomy as an opportunity for industrial development aligned with climate targets.

Portugal today controls all the value-creating phases in these bioindustries, from cutting-edge research in forestry, to global marketing of the sector's top brands. It has everything needed to seize the opportunity offered by its planted eucalyptus forests. It is therefore essential to recognise and embrace everything it can offer us - environmentally, socially, and economically - to build a more sustainable future for generations to come.

This is a holistic vision of the forest, which depends on what we do today, as a society, to foster genuine understanding and participation.

The Eucalyptus Forum has grown from this sense of mission, because to share ideas is to plant the future. ●

Never before as in the last five years has the circular economy been such a hot topic. Discussion, debate, and articles on the subject have almost tripled. Despite this tendency, global circularity is in decline. The 2024 Circularity Gap Report has highlighted this stark reality: in 2023, secondary economic materials consumed by the world economy accounted for only 7.2% of the more than 500 billion tons that we used. This figure is down from 2018, when the first Circularity Gap Report was launched, at the World Economic Forum, in Davos. It then stood at 9.1%

In other words, despite the growing awareness of the need for a more circular economy, in practice, things are not changing. The dominant economic systems remain rooted in a linear mentality and growing over-exploitation of resources. But if we still want to have a chance of meeting the targets set for global heating, we have to make the transition to a circular economy, where the principle is “extract/produce-reuse/reuse/reuse”. Ideally, resources would circulate endlessly in a closed loop, through continuous reuse and recovery. But in the real world, due to inefficient processes or technological and/or physical limitations, some of the resources are lost along the way. This means that the most effective way of achieving circularity is to substitute non-renewable resources with renewables, which can be sustainably regenerated, boosting our ability to meet the needs of mankind, whilst staying within the limits of the planet. This is what we call the circular bioeconomy.

We urgently need to move from a linear and fossil-based model of development to a circular economy, beneficial to nature and climate-neutral. Carefully managed forests are a key ally in this transition, as a source of bio-based and renewable products, able to substitute fossil resources with countless advantages.



**Centred
on
forests**

In this new economic paradigm, the forest plays a crucial role. Because it is the largest terrestrial carbon sink, the principal refuge of terrestrial biodiversity, and our largest source of non-food biological resources. In the forest-based circular bioeconomy, the biological resources used to produce goods are renewable and sustainable, and are found in the forest.

Multiplying the benefits

When managed responsibly, planted forests not only provide goods and services with a market value, such as wood, cork, and resin, but also offer a range of ecosystem services resulting from sustainable management practices. These include carbon sequestration, production of oxygen, promotion of biodiversity, soil protection, regulation of rainfall-related hydrological cycles, and creation of landscape amenities.

For this reason, a bioeconomy model that includes forests is essential, as it acts in three complementary areas: increased carbon storage in forests, the improved health and resilience of the forests themselves, through forestry management, and sustainable use of wood resources, to substitute non-renewable and carbon-intensive materials. The new bioproducts that can emerge from this range from food additives to biocomposites, from advanced biofuels to nanocellulose, substituting fossil-based materials in sectors such as packaging, construction materials, textiles, bioenergy, pharmaceutical products, and vehicle components. The future is bio, and it starts in the forest. ●



A new world of bioproducts

Molded cellulose packaging and papers with barrier properties are just two of a new generation of bioproducts, featuring low environmental impact and a superpower: they can substitute single-use plastics. This is only the start of a story that begins in Portugal's eucalyptus forests and is inspired by the future of the planet.

They are alternatives to fossil-based products and offer a range of properties needed to make the emerging bioeconomy grow and prosper. In other words, they are renewable, biodegradable, and sustainable, and are urgently needed in response to the climate emergency and the quest for a sustainable planet. The new bioproducts emerging from planted forests of *Eucalyptus globulus* are just the first. This ecosystem offers an inexhaustible source of materials that can be processed, on an integrated basis, at industrial facilities producing pulp and paper.

A new world in which Portugal has the potential to flourish. Our country has always been a pioneer in the industrial production and marketing of products derived from eucalyptus cellulose fibre, and is the top European producer of printing and writing papers. It is accordingly well placed – thanks to its forests, its companies, universities, and R&D centres – to take up a leading position in the new forest-based bioeconomy.

Produced not only from eucalyptus wood, but also from forestry and industrial waste products, the new bioproducts open the way to creating additional value for the pulp and paper industry and are also a clear example of the circularity that is sought in the new economic paradigm.

The new products that can be derived from eucalyptus forests range from food additives to biocomposites, from advanced biofuels to nanocellulose,

New papers with barrier properties

One of the next steps forward in the sustainable packaging that Navigator is creating through the From Fossil to Forest Agenda, is the development of packaging papers with barrier properties, by the end of 2025.

The idea is to make paper with characteristics that make it suitable for replacing fossil-based plastic as a raw material for packaging. In other words, it needs to be paper that won't absorb liquids, oils, or fats from foods, and which won't let in oxygen or moisture. Paper with barrier properties will be able to substitute fossil plastics in packaging that uses flexible film to contain various types of food products - both for sale in the retail sector, and for use in the takeaway business.

"Researchers are developing barriers to oils and fats, to steam, to oxygen and to water absorption, and these will be applied by means of coatings in water-based dispersions or by extrusion, and the Consortium has already assessed a number of promising solutions", explained Ricardo Jorge, Head of Research and Technological Consultancy at RAIZ. ●



Navigator is due to start up a new unit in the second half of the year to produce packaging in moulded cellulose, for use in the food sector.

substituting fossil-based materials in sectors such as packaging, construction materials, textiles, bioenergy, pharmaceutical products, and vehicle components.

A science-based transition

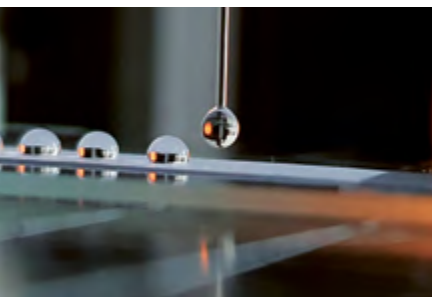
Portugal is well positioned for the transition to a new circular, low-carbon economic paradigm, based on renewable raw materials, and The Navigator Company has played a significant role in leading this shift. The Company is exploring the full potential of eucalyptus globulus to make it the foundation of a new generation of bioproducts that society urgently needs.

Thanks to a scientific research drive in recent years led by RAIZ (the R&D laboratory owned by The Navigator Company, University of Aveiro, University of Coimbra, and Lisbon University's Higher Institute

of Agronomy), the first bioproducts of this new generation have already created new business areas. This is an example of what can happen when industry joins hands with science.

Planet-friendly packaging: from the laboratory to the production line

In 2021, Navigator launched a new packaging paper range, under the gKRAFT brand - the first solution of its kind in the world, using virgin Eucalyptus globulus fibre to replace the single-use plastics dominating the packaging market. But this was just the first step on a promising journey that remains a priority for the Company's future. Packaging has been the area where the new bioproducts have established themselves most firmly, largely because of the urgent need for alternatives to single-use plastics,



Navigator is testing papers with hydrophobic (water-repellent) properties.



Eucalyptus globulus produces better raw material, and more of it, for the circular bioeconomy.

Transporting takeaway food is one of the applications for molded cellulose packaging.



which dominate the sector. Replacing these with carbon-neutral cellulose materials will bring a reduction in greenhouse gas emissions. But their positive impact on the environment extends further, because this packaging, sourced from forests, is highly recyclable and biodegradable at the end of its life.

Fibre products for packaging are at an advanced stage of development, exploiting the specific characteristics of Eucalyptus globulus fibres, in particular for the food sector, in the form of moulded cellulose products and packaging papers with barrier properties.

These new bioproducts are being developed through the From Fossil

to Forest Agenda, approved under the Recovery and Resilience Plan (RRP), which involves a consortium of 27 companies, universities, and research centres (including RAIZ9, led by The Navigator Company. The aim of the Agenda is precisely to develop, patent, produce, and market innovative packaging solutions - renewably sourced, biodegradable, recyclable, and carbon neutral - made from homegrown raw material, obtained from planted forests of Eucalyptus globulus managed on a sustainable basis.

Molded cellulose: new packaging for the food sector

Cellulose, today recognised as one

of the supermaterials of the future, can offer countless answers to the question of how to replace fossil-based materials. In Aveiro, at The Navigator Company's industrial complex, a new integrated production line is being built to make moulded cellulose packaging for the food sector, due to start up in the second half of this year. It will initially have capacity for 100 million parts, and is designed to enable capacity to be scaled up in the next few years. The new range, known as Bioshield and marketed under the gKraft™ brand, will start up with products for the food service and food packaging sectors. Takeaway containers, for instance, are one



In 2021, Navigator launched a new packaging paper range, under the gKRAFT brand, to replace the single-use plastics dominating the packaging market.

of the target applications. “All the moulded cellulose articles will have barrier properties, suited to their end uses”, explained Ricardo Jorge, Head of Research and Technological Consultancy at RAIZ. “One example of molded cellulose that is familiar to all of us is the material used to make egg cartons”, said the manager. “But unlike those cartons, which are made from recycled materials, the packaging in the new range developed by Navigator is produced from virgin eucalyptus fibre, which is ideal for food contact and safety”, he told us. The products have been developed to ensure they meet the requirements currently in force, in the different

target markets.

In 2023, a pilot facility was acquired and installed at RAIZ, able to produce the prototypes for products of this type, using different water-based chemical additives, in order to develop and select the formulations that best meet market requirements for barrier properties - especially against oils and fats. Performance tests have been conducted on the prototypes, under real conditions of use.

Technicians in the Research and Development sector at RAIZ have worked closely with staff from the industrial divisions, to ensure that the solutions developed are aligned with

Other bioproducts being developed by The Navigator Company

- Cellulose sugars and conversion of these into bioethanol for use in biofuels.
- Cellulose fibre biocomposites and thermoplastic matrix materials, notably for bioplastics such as PLA, for use in injected plastic of thermoforming products, filaments, and technical textiles. These applications are being tested with potential end users.
- Essential oils and bioactive products extracted from eucalyptus bark and foliage for a range of applications, such as cosmetics and healthcare. ●

the envisaged production techniques.

“The new unit producing the moulded cellulose range for the gKRAFT brand will be the first in the world to use eucalyptus fibre - an outstanding raw material for a variety of paper products - to manufacture articles of this type”, explained Ricardo Jorge.

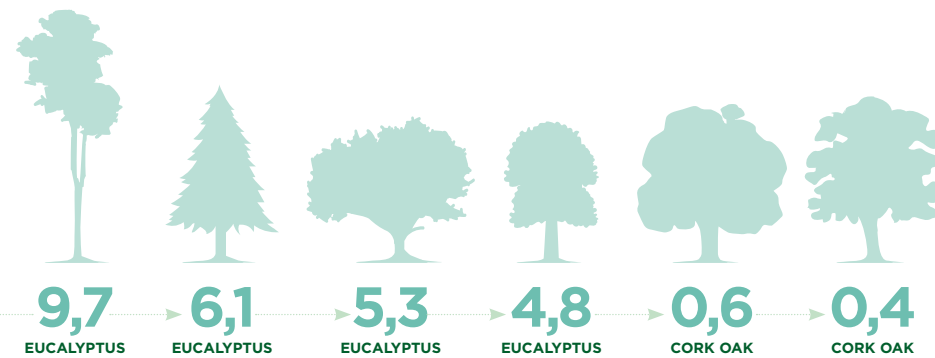
“This new range, consisting of articles with less environmental impact, because they are recyclable, compostable and biodegradable, will underline the sincerity of the Company's purpose, which states that ‘It's thinking about people, their quality of life and the future of the planet that inspires and motivates us’”, he concluded. ●

IN THE FOREST

Average forest yields by species in Portugal (m³/ha/year)

In a similar sized area, eucalyptus produces more wood than other species.

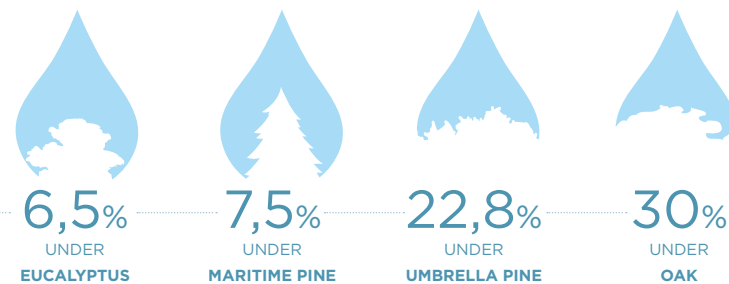
Source: Matriz Estruturante do Valor da Floresta, DGRF, 2007



Water interception by eucalyptus and other forests (percentage of precipitation not reaching ground)

The shape of the eucalyptus' crown and leaves allows more water to reach the ground, maintaining moisture and feeding aquifers.

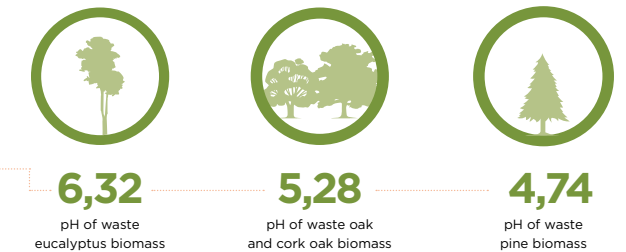
Fonte: Gras, J.M, 1993; Gonzalez et al, 1983



pH Soil acidification by organic waste

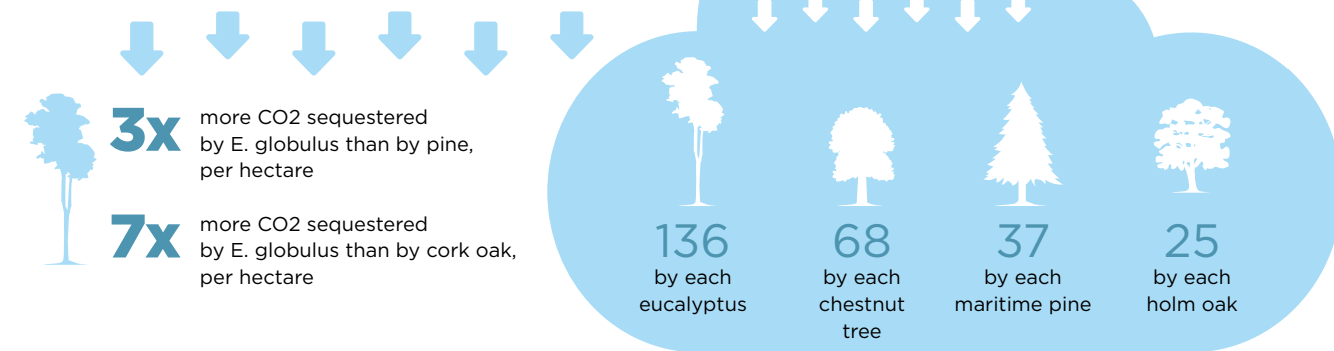
The nutrients and organic matter that eucalyptus returns to the soil result in a better acidity balance, boosting fertility.

Source: "Influencias de nutrientes y polifenoles vegetales en la humidificación de la hojarasca de especies autóctonas e introducidas en la provincia de Huelva", Domínguez de Juan et al



CO₂ Sequestration of CO₂ by eucalyptus and other species (kg CO₂/year sequestered by each tree)

Due to its shorter cultivation cycle, eucalyptus sequesters more carbon than other trees.



Source: Monografias INIA, serie Florestal 13, Ministerio de Medio Ambiente

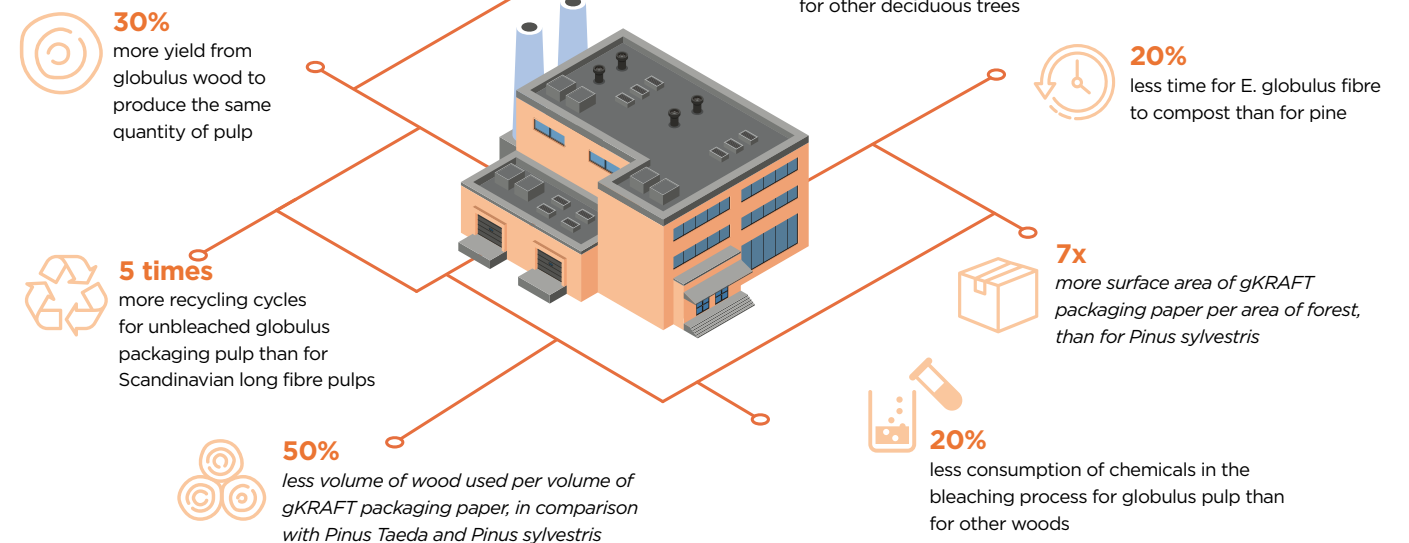
The advantages of eucalyptus for the forest-based bioeconomy

The future will be growing demographic pressure on resources and a greater demand for forestry materials to substitute fossil-based products and energy. In this scenario, managed eucalyptus forests contribute to the solution.

Eucalyptus globulus has unique characteristics enabling it to take the lead in this new development paradigm. Compared to other planted forests, it yields more wood from the same area, as well as demonstrates significant efficiency in water use, consuming less water per cubic metre of wood produced. Its ability to sequester carbon is also outstanding, out-performing other planted forests in Portugal and areas of brushland. The use of cellulose sourced from forests, rather than from agricultural crops,

in the bioproducts industry helps to ease the pressure on farming land for food production. In addition, it takes less wood to produce the same quantity of the pulp used to manufacture bioproducts. The eucalyptus raw material is easier to process, resulting in less environmental impact because fewer chemicals are consumed. Lastly, eucalyptus globulus fibre can be recycled more times than other competing woods.

IN INDUSTRY



(Fontes: RAIZ; Navigator)



Portugal needs to produce more in order to import less

Every year, Portugal imports tons of wood which could be produced at home. Planting more forests and increasing yields are feasible ways of avoiding the huge economic and environmental costs of shipping these raw materials.

Although forests occupy more one-third of Portuguese territory, there is still not enough home-grown wood to meet the needs of the various industries that depend on it. These industries enjoy an international reputation for quality and innovation and are responsible for significant National Value Added. Despite this, they have to resort to imports to respond to the growing need for forest-based products, offering natural and renewable alternatives to fossil-based materials, as the world shifts towards a new circular and sustainable economic paradigm. This scarcity of raw materials - leading to an increase in imports of wood, often of a quality inferior to that produced in Portugal, and with the economic and environmental costs it causes - is not, however, inevitable. In other words, there is real potential for increased production

in Portugal, which for years has gone to waste. On the one hand, 12% of the country consists of brushland or uncultivated land (COS 2018), most of it of no conservation interest, which could be occupied by forest. On the other hand, the yields from existing areas could be boosted by improving forestry practices. Together, these two facts offer an opportunity to gain a competitive edge, an opportunity that Portugal is failing to seize. Above all, considering that the soil and climate in Portugal are especially well suited to particular species, such as *Eucalyptus globulus*. Whatever the main reason for the shortage of raw material - limits on plantations, in the case of eucalyptus, phytosanitary issues and ageing in cork oak woodlands, or reduction in production areas, as in the pine sector -, the country clearly has the potential to produce more.



PINE

1,77 Mm³
Wood available

3,98 Mm³
Wood consumed

-2,21 Mm³
Shortfall in wood

(Figures for 2022;
Source: Indicadores da Fileira do Pinho 2022, Centro PINUS)



EUCALYPTUS

975
thousand tons
Raw wood imported from Spain

953
thousand tons
Raw wood imported from Brazil

(Figures for 2022;
Source: Fact Sheet e Outlook Florestal - Fileira do Eucalipto, Millennium bcp, July/August 2023)

A changing economy

Portugal's forest-based industries have evolved into a sector with a high level of national value added (because it incorporates Portuguese manpower and raw materials on a large scale), responsible for 6% of GDP and, in 2022, 9% of the country's exports, according to figures from the National Office of Statistics (INE). INE figures for the same year also show that forestry exports increased to more than 7 billion euros, the highest ever level - demonstrating the importance of the sector to Portugal's international trade. However, forestry output has failed to keep up with international demand, compromising the future growth of existing industrial clusters and those set to emerge in the near future - due to growth in many of the existing uses, and also to new uses in bioproducts.

The importance of planted forests

Worldwide, planted forests account for only 7% of the total forested area, but they meet more than half of the industrial demand for wood, according to the FAO, clearly showing the importance of these plantations to society and the economy. In Portugal, forests today occupy more

than 3.4 million hectares, in other words, 39% of all Portuguese territory, according to the 2018 Land Use and Occupation Map (COS 2018). This is much more than in the late nineteenth century: according to an estimate published in Geografia e Estatística Geral de Portugal e Colónias como um Atlas, woodlands accounted for only 7% of all land at that time. Portugal's forests have grown thanks to planted woodlands. Many of these planted forests were originally created for production or protective purposes, but today they perform a host of other functions, including provision of environmental and cultural services.

Eucalyptus forest

In 2022, Portugal imported eucalyptus wood worth 375 million euros, according to INE figures. Figures from Forestry Outlook - Eucalyptus Sector (published by Millennium bcp) show that imports of raw wood, of quality inferior to home grown wood, have risen gradually since 2017, by around 14.5% a year, meaning an overall increase of 97%, from 2017 to 2022.

Europe consumed more than 8 million tons of eucalyptus fibre in 2022, but only produced 30% of its needs. Production is limited to the Iberian peninsula, the only European region with the right soil and climate conditions. The rest is imported from Latin America, with obvious negative impacts on the trade balance, not to mention the risks to the resilience and security of European supply chains and the increased carbon footprint resulting from the emissions caused by long-distance transportation.

The montado - cork oak woodlands

Portugal is home to 34% of all the world's cork oak woodlands. Even so, not enough cork is grown to meet the needs of the cork industry. In 2022, the pace of growth in the sector meant it needed to import 53.9 thousand tons of raw or prepared cork, at a cost of 138 million euros, according to INE figures. Data from APCOR shows that 10% of

the total cork used in industry comes from other countries, making Portugal the world's third-largest cork importer. Significantly, 46% of world cork output bears the Portuguese seal of origin.

Imports of pine timber

The pine sector also contends with a structural shortfall in raw materials to meet the needs of the industry. In 2022, this shortfall corresponded to 56% of all the pine timber consumed by industry, according to the Pine Sector Indicators 2022, issued by the PINUS Centre. Also according to the PINUS Centre, 8.1 thousand hectares would have to be reforested with maritime pine each year in order to meet the targets in the National Forest Strategy. However, in the 2022-2023 season, only 3.2 thousand hectares of pine woods were planted (calculated on the basis of the number of certified plants, allowing for wastage of 15%). ●

12% of Portugal's territory consists of brushland or uncultivated land (COS 2018), most of it of no conservation interest, which could be occupied by forest.



CORK OAK
34%

of the world's cork oak woodlands are in Portugal

46%
of all cork is produced in Portugal

(Source: APCOR figures)

It's the income from eucalyptus forests that enables other species to be planted and managed

The shortage of wood in Portugal is a problem affecting all forestry segments and results in heavy costs for the country, as industry is forced to purchase abroad wood that could have been grown at home.

The companies behind Biond (The Navigator Company, Altri, DS Smith, and Renova) together process each year around 8.4 million m³ of eucalyptus wood and 0.6 million m³ of pine wood. Because the country's output has been manifestly insufficient to meet its needs, the alternative has entailed increasing imports.

The shortage of wood is damaging to the sector, but also to the country. Economically and socially, because it is holding back growth in one of the engines of the Portuguese economy: the eucalyptus sector alone provides 80 thousand jobs in Portugal, and last year alone, the pulp and paper cluster recorded exports of 3.1 billion euros, equivalent to around half of all foreign sales by the forestry sector. From an environmental perspective, because without well managed woodlands, the decarbonisation targets to which Portugal is committed are in jeopardy.

Several factors contribute to this shortage of raw materials. These range from red tape, caps on investment in planting or replanting eucalyptus, and a lack of active management, to abandoned land, highly fragmented ownership, and a lack of registry data, as well as climate change, bringing an increase in fires, pests and diseases. But without doubt the main cause is the lack of an adequate national forestry policy. We have



submitted impartial proposals to the ministerial authorities, with a view to a sector-wide agreement, absolutely essential if we are to alter the current state of affairs. In the years following the fires of 2017, the government decided to restrict the planting and replanting of eucalyptus, without any technical or scientific grounds. The situation is even more serious insofar as the restrictive policy on eucalyptus is harming forestry as a whole, as it has been shown that it is the income from eucalyptus forests that makes it possible to plant and manage other species.

Big changes are needed in Portugal's forests, to bring a new dynamic. This should be geared toward increasing the supply of wood and to the long-term sustainability of bioindustries, at the same time as providing environmental safeguards for the

country's woodlands, to meet decarbonisation targets and consequently generate wealth for the country.

Opportunity in the bioeconomy

Thanks to extensive research and the development of new technologies, cellulose fibre is today one of the supermaterials of the future, accelerating the transition to a circular bioeconomy. Already familiar products (household papers, writing and printing paper, packaging paper, and cardboard) are now being joined by cosmetics, food supplements and additives, articles for the nutraceutical and pharmaceutical industries, textiles, components for the automobile and aerospace industries, biofuels, biocomposites, etc., manufactured from wood sourced from planted forests.

The demand for this raw material will therefore tend to increase worldwide, and Portugal should make the most of its good fortune in having the ideal soil and climate conditions for the world's best eucalyptus (*eucalyptus globulus*), in terms of fibre quality.

Before taking this argument further, we have to realise that the raw material supplying this sector is obtained from production forests, i.e. forests that are planted and replanted for this purpose and then properly managed, in order, among many other things, to avoid fires, due to being more resilient, and to promote carbon sequestration - forests sequester 15% of Portugal's greenhouse gases, equivalent to the annual emissions from the Porto Metropolitan Area. If Portugal can seize these opportunities, it will bring the country economic and environmental gains. ●

by Gonçalo Almeida Simões, General Manager of Biond – Forest fibers from Portugal

Better management, greater yields

Until it becomes possible to plant in new areas, the solution to the shortage of raw material will inevitably involve increasing eucalyptus yields. To do this, eucalyptus plantations need to be relocated to areas with better potential for yields and management standards need to be raised across the country, encouraging as far as possible combined and large-scale management, with the adoption of best forestry practices.

Biond knows how this is done and its track record confirms the benefits of the approach that we call for. Examples of this include the Clear and Fertilise Programme (working on more than 70 thousand hectares and supporting more than 7,600 landowners), the Mortágua Fire Recovery Programme (work on 550 hectares and support for 210 landowners) and the Pedrógão Replanting Programme (recovery of 140 hectares, support for 44 smallholders and creation of 54 km of paths and fire breaks). ●

We value forests, we protect the environment

Over the past 50 years, public policy has been disastrous for forests, and to recover from this we will need at least 30 years of hard work, to undo all the harm that has been done and to dismantle the hostile measures that have been put in place. AIMMP is ready and willing to put its weight behind an honest and balanced plan, committed to the future success of Portugal's forests and related industries in the medium and long term. Despite all the needs assessments, surveys, debates, interviews, opinion leaders, legislation, overhauls of public authorities and ministerial powers, budget allocations in the millions, and even human tragedy and destruction of property, the results have still been disastrous! Every day we hear what has been demonstrated beyond doubt: that woodlands are left untended, inland regions abandoned, and a shortage of manpower in these sectors; that many landowners hardly know or else fail to recognise what they own, not to mention that, in many cases, properties are owned by multiple owners because inheritances were never divided; Roughly speaking, we know that around 91% of Portugal's forests are owned by some 500 thousand smallholders, and that, in northern and central Portugal, the average size of each property is just 0.5 ha, leaving a disorderly patchwork of tiny holdings, where fires can spread easily and economies of scale are impossible, rendering these woodlands unprofitable and unable to attract people's interest; We also know that the main tree species making up Portugal's



3.3 million hectares of forest are eucalyptus, pine, and cork oak and that the other species together account for only the same as one of the three main species (more or less 25% of the area). We also know that forest yields in Portugal are extremely low for all the species and the quality of yields could be substantially better; We also know about the international shame of having an average of 20,000 fire ignitions per year in the past 30 years, more than the average total for Spain, France, and Italy combined, and that more than 100,000 hectares are burned down each year in Portugal, with some areas and regions suffering fires 7 or 8 times; We also know that Portuguese companies, in all industrial sectors, are increasingly dependent on imports of raw materials, with a huge increase in their costs and damage to their ability to compete internationally; We also know that there is a market for increased exports from the forest-based sector and that forests are society's best ally in mitigating climate change, protecting

the environment and biodiversity, pursuing sustainability and the circular economy, and creating wealth and social well-being in our regions.

If we don't act quickly, we will lose one of Portugal's greatest natural resources, with the potential to be economically, socially, and environmentally sustainable

What we need is to counter these tendencies. I don't want to believe that Portugal's forests will continue to be overlooked and neglected. We have a precious asset that is wasted, criminally vandalised, and ravaged by fire, and which we need to tend, cultivate, care for, protect, and put to economic and environmental use. The State must accept its responsibilities, arrange finance, act as a facilitator, provide training, pursue research and development, as well as address the risks, guarantee safety, and maintain the forest road network. Our hope is that new forestry enterprises will be set up with substantial public and private investment, from Portuguese and international sources, so that, by investing in land, through purchases, exchanges, associations, and schemes for landowners to exchange their holdings for shares, etc., it can be possible to manage property and forest holdings in such a way as to create larger operational units and a more professional business model, whilst attracting skilled labour to forests, by boosting profits and incomes. There are sufficient forests for everyone in Portugal, meaning that such an undertaking would not clash with the need for community woodlands given over to more than just production. ●

*by Vítor Poças, Chair of the Management Board, AIMMP
Association of Portuguese Wood and Furniture Industries*



Remarkable growth

Between 2011 and 2023, the value of exports from the wood and furniture industries more than doubled, rising from approximately 1,500 million euros to 3,164 million euros*, with around 78% of exports going to the European Union. As a result, the trade surplus resumed its upward trajectory, reaching 569 million euros in 2023. Of course, there is still a long way to go and the main challenges we face, as a business association, require us to address a variety of issues to promote

the industry's development. These include promoting and managing our forestry resources, our main raw material, raising the standard of management practices, permanent gathering of economic intelligence throughout value chains and business circuits, as well as pragmatic and active efforts to promote and retain talent, innovation, better technology, design, sustainability, international promotion and improvement recognition of Portugal's "brand",

as a factor conferring a sustained competitive advantage and leading consumers to choose and value our products AIMMP is eager to be at the forefront of action and projects to make us more competitive and boost ESG credentials for the sector and Portugal. ●

*These figures refer to exports of non-wood seating, furniture and cupboards, upholstery, and lighting apparatus.

Looking to the future with confidence and ambition

The area occupied by cork oak woodlands in Portugal – 720,000 hectares, according to the most recent data from the 6th National Forest Inventory – held relatively steady between the last two surveys available (2005 and 2015), if we compare it with the wider scenario in Portugal's forests. There was, however, a drop of around 4%, equivalent to approximately 26,900 hectares.

Nonetheless, it is not just this reduction in area that causes us concern about the availability of raw materials in Portugal. It is rather the declining density of cork oak woodlands, caused, among other things, by the health of the trees, which has caused yields to dwindle in the years we analysed. Around two-thirds of Portugal's cork oak woodlands have a density today of less than 80 trees/hectare, and this is clearly reflected in lower cork yields. For the industry, the declining yields of cork oak woodlands in Portugal are cause for real long-term concern, making it even more important to adopt measures in the field to increase output. This is because, even if we start today, the benefits will only be enjoyed in the medium to long term.

This is true both in the global wine industry, in which seven in every ten bottles worldwide use a cork stopper and in the many other applications in a range of areas where, thanks to its technical characteristics and sustainability, cork enjoys growing demand and has the potential to attract an even wider market, through international policies for substituting fossil-based materials

Notwithstanding the need to learn more about certain areas of younger stands (approximately 60,000 hectares), the diagnosis is soundly



©Daniel Rodrigues

based and shows, as we have described, a decline in phytosanitary health causing a drop-off in potential yields, accentuating the imbalance between supply and demand. An integrated response is needed, and a sector with renewed energy and ambition, to restore the health of cork oak woodlands, thereby increasing production areas and improving average yields.

One fact is undeniable. As the world leader in the sector, Portugal is uniquely placed to take action, and the responsibility starts with us! We have the scientific expertise, a sector united in its goals, from producers to manufacturers, and supported by the strategy of the cork industry association, Filcork, which has established plans that align our vision, metrics, and timings. For all these reasons, and because the sector's vision is aligned with the main objectives of the country's forestry policy, we believe the future can bring progress and turn around the tendency for decline described above.

More and better cork

If we are to produce more cork, and of better quality, we need an approach that looks carefully at how things work today, to build on this and arrive at the cork oak

woodlands of the future.

In the immediate future, it is fundamental to restore and improve our existing woodlands, taking action in around half their current area, i.e. over an area of 350,000 hectares, and to invest in certifying a further 200,000 hectares, because of the positive effect of good practices on the vitality of this ecosystem. Looking to the future, potential areas for planting need to be assessed and catalogued, but above all we need an ambitious plan to plant cork oaks over an area of 50,000 hectares, using new forestry models and technologies.

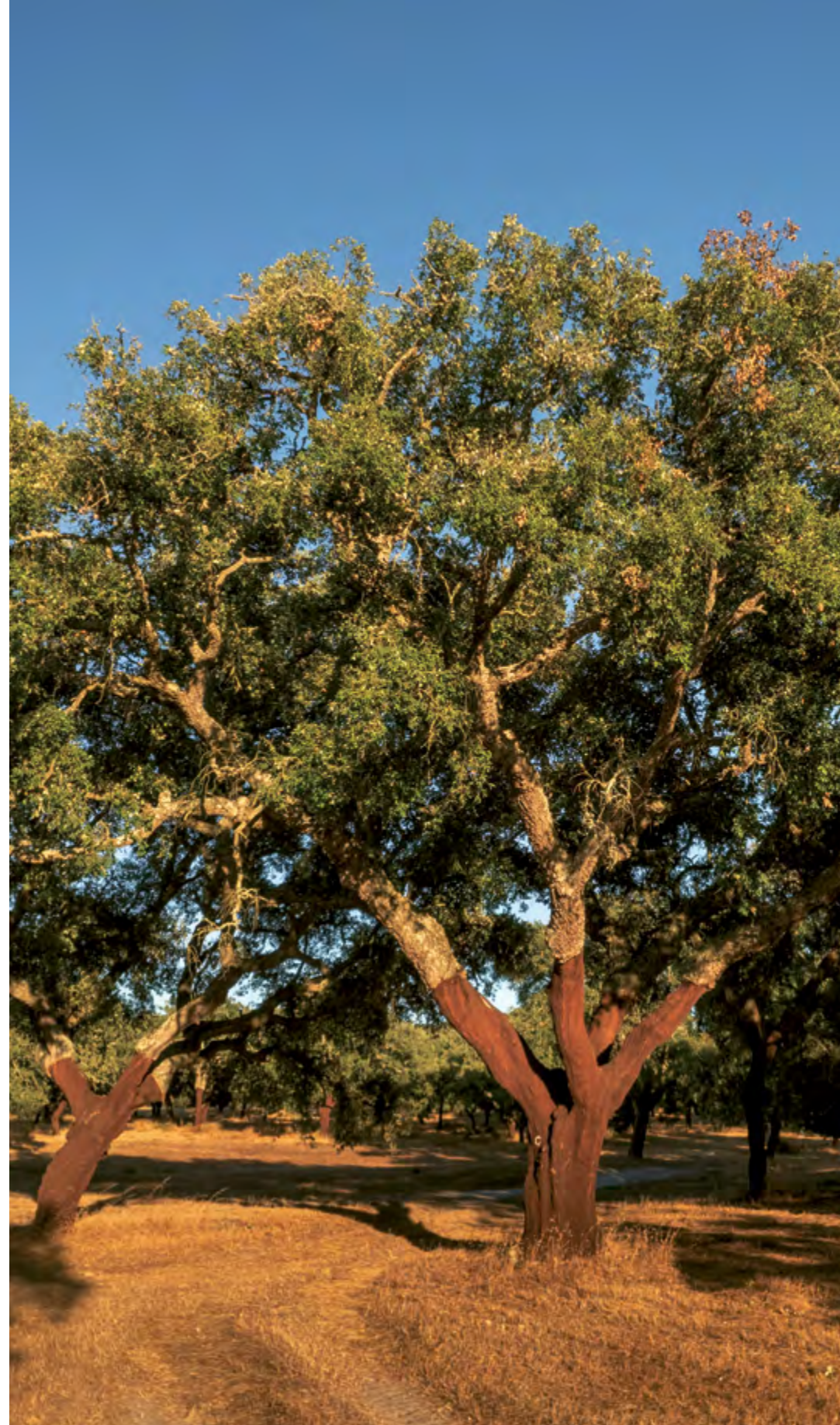
It is important to secure clear public recognition of the environmental value of cork oak savannas and to find ways of remunerating the multiple ecosystem services they provide. An R&D programme will need to look, among other things, at the health and vitality of cork oaks. Most of these ideas have been organised and incorporated in the National Cork Oak Programme, a long-term strategy document, drawn up after a government initiative to sign agreements with the three main forestry sectors. Filcork and the ICNF have worked closely with the Ministry of the Environment and the State Forestry Department, leading to agreement in outline on the National Cork Oak Programme, and on the main areas of action, timeframes, and budget allocations. As the incoming government takes up the reins, we are ready and willing to work with them to ensure that this Programme is adopted, so that an action plan can be drawn up. In order to succeed in the long term, the work has to start now.

Cork is a material uniquely able to help us adapt to a circular economic model, and new opportunities have been identified for substituting fossil-based and artificial materials. Because cork offers an unrivalled response to global challenges, we can look to the future with confidence and ambition. ●

by João Rui Ferreira, Secretary-General of APCOR (Portuguese Cork Association)

Onwards and upwards

The Portuguese cork sector can take pride in the balanced and sustainable growth achieved over the past decade, averaging 4% a year. Even in the fairly complex economic environment seen in the second half of 2023, causing demand and turnover to contract, the sector recorded growth of 2% in exports, to just over 1.23 billion euros. The uncertainty in global markets in early 2024 should not obscure the fact that this is a moment to regain our competitive edge and move into a fresh cycle of growth. Our sector faces countless challenges, and we shall continue to invest in international marketing, to explain the full potential of cork to new audiences around the world, to invest in upgrading our technology and developing new applications, and to invest in the people in our sector and their skills, in line with this wider context. ●



©Joel Santos & Magali Tarouca

We need a real national strategy for resin tapping

In recent years, Portugal has produced around seven thousand tons of resin a year, not enough for 10% of the needs of our primary and secondary processing industries. This means that industry is forced to import most of its raw materials, mostly from South American countries. This is due in part to a significant reduction in the area of maritime pine woods in Portugal in recent years, and big changes in these woodlands.

Stands of medium to large trees, with diameters attractive for saw mills are currently a rarity in Portuguese pine woods. What we have is large areas of pine forest, most of it very young and naturally regenerating, where no forestry work has been carried out for several years, meaning that there is a clear lack of professional management in these areas. This fact significantly limits the production of resin, as the sector needs large areas with average diameters of more than 20 cm, and these are increasingly difficult to find.

Considering that the principles of the bioeconomy point to an economic model where fossil resources are substituted by renewable resources, the natural resin has much to offer, as it can directly replace petroleum derivatives in the manufacture by the chemicals industry of a huge number of products widely used in our daily lives. The forest-based bioeconomy also involves economic and social development driven by the sustainable use of resources on a regional



basis. So if we continue to lack a real national strategy for resin tapping and our pine woods in general, we will see the ill effects of neglect on these woodlands and our industries will be forced to increase imports of raw materials, going against many of the principles of the bioeconomy that the country hopes to implement. ●

by Marco Ribeiro, Chairman of Resipinus



With their feet on the ground

No one knows the forest better than those who, every morning, put on their boots and head out to put active and responsible management into practice. It can be a hard life, but forestry producers still speak passionately about their plans, their trees, their woods, and the growth, literal and figurative, of their forests. Which are also our forests.



“It can still be tough, but I never let that stop me doing what I love.”



Carlota Lisboa

Partner and Manager, Sociedade Agrícola Cordeiro Lisboa

“I love working in the countryside, the connection with the land”

“When I became a partner and manager of Sociedade Agrícola Cordeiro Lisboa, at the age of 25, I didn’t just take over as manager of the property, I inherited a family tradition that dates back to my grandmother’s time”, explained Carlota Lisboa, a woman whose connection to the land is rooted in her own family. Farming, forestry, and hard work have always been part of her daily life. “The land I manage now was cared for by my grandfather, and then by my father”, she tells us. Although her father, Manuel Lisboa – the same name as her grandfather –, had wanted his children to follow other paths, Carlota always knew that her place was in the country. “I decided to make it a full-time occupation”, she says with conviction. She studied farm management at Santarém Agricultural College and on leaving, in 1988, returned to the family properties to put her studies to practical use. With the support of her siblings and the rest of the family, she took over from her father as manager in 1994, facing up to the challenges with

determination and enthusiasm.

For her family’s land to be profitable, she needed to diversify, and her enterprising spirit led her to explore new opportunities. She applied to a scheme whereby farmers could convert their land to forestry, investing in cork oak, umbrella pine, and eucalyptus. She kept back the most productive land for annual crops, such as strawberries, broccoli, peppers, and corn; but in 2000 they decided to convert this land to olive groves.

It has not always been easy, especially as a woman in what is still a male-dominated world. It can still be tough, but I never let that stop me from doing what I love, she says with a smile.

Despite the difficulties, Carlota Lisboa wouldn’t choose any other life. “I love working in the countryside, the connection with the land”, she tells us with pride. Her legacy is a living testament to the strength and resilience of women in the farming and forestry sector, and her story has inspired others to follow in her footsteps.●



“In this job, we have to turn our hand to everything”: in the photo, Carlota Lisboa selects eucalyptus saplings.

Rui Silva

Serra do Gerês Common
Land Officer

“Certification encourages people to look after the land”

In the Peneda-Gerês National Park, the community lands for the village of Pincães extend over 1,947.8 hectares, consisting of brushland, pine woods, arbutus, oak forest (mostly Pyrenean and pendunculate oak), cork oak and other deciduous trees in riverbank gallery forests. Almost the whole area (99.98%) is certified for ecosystem services, with a focus on the conservation of biodiversity and native deciduous species, as well as carbon sequestration and storage. This is a natural choice, as the land is all contained within protected areas under the Natura 2000 Network.

Many of the trees here are over a hundred years old, and Rui Silva, who works for the Serra do Gerês grouping of common land holdings, to which Pincães' community lands belong, is familiar with all of them. Born and bred in the region, he's proud to tell us that “people who live here are increasingly focused on the natural world around them and are truly concerned with environmental conservation”.

One of the most emblematic sights in the common land is the arbutus forest, located near a bend in the road, where the trees have withstood fires. Although the national park has been affected by fires in recent years, the areas occupied by native deciduous trees have proved fairly resilient. An example can be found in the lush green of the part of the Pincães community lands which has undergone restoration work since the fire in 2018.

This success is not unconnected to the certification process, Rui Silva tells us: “The fact that we obtained forest management certification in 2018, and more recently certification for ecosystem services, is something that obliges us to look after the land.”

“The people who live here are increasingly focused on the natural world around them and are truly concerned with environmental conservation.”



The village of Pincães has common land owned by a community assembly, with 79 members.

One way of keeping undergrowth under control and reducing the fire risk is *vezeira*, the traditional practice of community pasturage. In Pincães, there are 170 goats and sheep, 165 cows and Garrano horses. Whilst the cattle and horses graze in the higher, more sparsely vegetated land, the sheep and goats enjoy the lower altitude pastures. These two types of pasturage are part of a sustainable way of life, rooted directly in nature, which has been followed in the region for centuries, and which arouses the curiosity of visitors. “Certification of ecosystem services also enables us to boost tourism and work to attract the type of tourist we want for Pincães and the National Park”, explains Rui Silva. “The common land has been actively managed, with pruning, thinning, and control of vegetation, and the results are clear to see.”

In the future, Rui Silva believes this certification can be expanded to include other services, such as slope stability (provided by trees), honey production (there are eight apiaries in Pincães, each with around 50 hives) and even commercial farming of arbutus. “Everything that's a step towards a better forest is welcome”, he says. ●





“These projects make for more active management and better tended woodlands.”

José Rafael

Forestry producer from Alenquer

“We just look after the forest for future generations”

Forestry is not José Rafael's main occupation, but it's been a passion from an early age. A civil engineer, he manages 500 hectares divided between four properties around Alenquer, applying a new management model designed to ensure continuous production. “I like to say that we've gone from being forest landowners to forestry producers. This has taken time and we're now at the final stage, which is planning operations to ensure uniform production”, he explains. “What we have here is an average yield, combining plots with varying production capacity”, he told us, acknowledging that “this takes time, a holistic approach, and a long-term strategy”. With poor heathland soils and a microclimate in which the uplands of the Serra de Montejunto provide protection from the Atlantic, the Quinta da Vassala e Vala Nova is home to both vineyards and eucalyptus plantations. This is a business with long-established roots: it was José Rafael's father who first planted eucalyptus on the farm in the 1950s, on previously uncultivated land. Since the turn of the century, some areas of eucalyptus have been converted to vineyards, so that the property now features an agro-forestry mosaic landscape.

In order to boost the yields from his eucalyptus plantations, without increasing the area, José Rafael signed up for the Clear & Fertilise programme, run by Biond, the association of forest-based bioindustries, as part of the Better Eucalyptus project. “With this help”, he tells us, “we succeeded in improving yields, with lower costs”. The Clear & Fertilise programme aims to help forestry producers adopt best practices in running their eucalyptus plantations. At the Quinta da Vassala, the programme provided help with approximately 100 hectares of certified eucalyptus forest, with trees that are now six years old. For José Rafael, this brought several advantages: “As well as improving yields, there is also control of weeds and the heat load. The industry is right to support this kind of work because it encourages producers to manage their forests better, increase their yields, and reduce risks by controlling vegetation and weeds”, he explained. José Rafael has no doubts about the positive impact of this intervention, “which leads to more active management and better quality forests”. “We don't really own the forests, we just look after them for future generations”, he concludes. ●



Quinta da Vassala, with vineyards alongside eucalyptus plantations.

Jorge Cotrim

Production manager at Agrozel

“Good management is reflected in better yields”

“Our plantations stand out because they’re well managed. We control the undergrowth and invasive species, which are a problem in this region, because of all the smallholdings, many of them abandoned,” we heard from Jorge Cotrim, production manager at Agrozel. Based in Ferreira de Zêzere, the company is involved in cattle and arable farming, as well as forestry, managing almost 600 hectares of eucalyptus, across the municipalities of Ferreira do Zêzere, Tomar, Abrantes, Sertã e Torres Novas.

Responsible forest maintenance is possible thanks in part to support from The Navigator Company, whose Premium Programme has contributed to the high management standards in Agrozel’s eucalyptus plantations. The company signed up for the programme in 2022, and one year on the production manager is satisfied it was the right decision: “We do harrowing, selection of saplings, control of invasive species, fire prevention. All this effort is reflected in better yields”.

Jorge Cotrim is passionate about forestry and is always looking for new opportunities for improvement. In 2022, he achieved another of his goals: to have an irrigated eucalyptus plantation. The Navigator Company helped with the project, in the selection of eucalyptus varieties and land preparation: a drip irrigation system was installed over nearly 30 hectares.

“It was a relatively easy project to implement”, recalls Jorge

Cotrim. “Alongside this plot, we have chestnut trees with irrigation, and so we simply had to extend the pipes to cover the new plantation.” This year, the system will add nutrients to the water, and here too the support from the Premium Programme has been invaluable. The water comes from a borehole and the water needs of the plants are monitored by the company’s technicians. “I’m really happy with the results so far. The plants have grown enormously in one year”, the production manager told us. The planting layout is 4 metres by 1.80 metres, and this year we had to irrigate five times, all of it during the summer.

Jorge Cotrim underlined the advantages of joining the Premium Programme: “It’s always useful to be able to benefit from the expertise of the technical staff from Navigator and RAIZ”. ●



The new Agrozel eucalyptus plantation, with drip irrigation, benefited from technical support under The Navigator Company’s Premium Programme.

“We do harrowing, selection of saplings, control of invasive species, fire prevention. All this effort is reflected in better yields.”



The Navigator Company's rental programme means Miguel Guerreiro enjoys increased financial security and has more time to manage his land.



Miguel Guerreiro

Forestry producer and forestry service provider.

“Drought is our main enemy”

Miguel Guerreiro's work consists partly of production forestry - he is in charge of two thousand hectares, some of it his own land, and some rented or under management contracts, across the municipalities of Odemira, Ourique, Aljezur, Monchique, and Silves - and partly of forestry services, ranging from cork extraction to undergrowth clearance. Forestry has been his life since he was eighteen. Twenty-two years ago he set up Relíquia Florestal, a forestry enterprise in Relíquias. In southern Portugal, the shortage of water and recurrent years of drought are the main constraints on yields from his forest plantations. “It's our main enemy, the others are nothing special”, he smiles. “In this region, the lack of rainfall has reduced production and increased the fire risk”, Miguel Guerreiro continued, speaking more seriously again. The uncertainty means we have to be on our toes, to work with nature's timings, so as not to miss opportunities. “We used to say when the autumn comes, we'll start to plant... Now we start to plant if it rains! And then we plant in the spring, but end up stopping if the rain dries up. So we have to have plants always at the ready”, he explains.

Maintenance work is also influenced by the climate, and forestry operations have to take place outside the fire risk season. “And that season can last up to five months here when there's practically nothing we can do. By then, we have to have everything ready to deal as best we can with the fires we hope won't come”, he tells us.

The decision to rent 420 hectares of eucalyptus plantations to Navigator was influenced by this. Miguel Guerreiro opted for the fixed rent system which is one of the oldest schemes to support the rental sector (it has operated since the 1970s). There is also a variable rent option.

In the fixed rent system, the owner receives a fixed annual payment, over 24 years - equivalent to two eucalyptus harvests. Under the variable rent system, the landowner receives a percentage of the value of the wood when it is felled.

“It was the fixed annual payment that attracted me to the rental programme. It's easier for me to get paid consistently than all in one go”, he confesses.

Complying strictly with good forestry practices, and being a service provider himself, Miguel Guerreiro is very conscious of the value of the support for Relíquia Florestal's operations. “It doesn't cover everything that has to be done, but it does offer a degree of financial security that leaves me with more time to get on with managing the plantations”, he assures us. ●



In total, Miguel Guerreiro is responsible for two thousand hectares of forest.



Francisco Freire

Forestry manager at the Marvila Estate.

“It’s important to pool resources and work as a team”

Forestry manager at the Marvila Estate, in the Portalegre district, Francisco Freire is confident that “producers and industry can work together for more sustainable and more resilient forests”.

This was the spirit in which he recently planted 190 hectares of eucalyptus with technical support from The Navigator Company. “The company’s technical staff provided all-round support, for the new plantation to be a success. At the end of the day, we have a shared interest: the best yield possible in terms of cubic metres of wood per hectare”, he told us. He believes that a close relationship between forestry producers and industry “makes a lot of sense, as the raw material is going to be used by the industry, and working together is fundamental to ensure proper planning of land use, for a balanced landscape and biodiversity”.

The new plantation managed by Francisco Freire is now part of the Winwood programme, also run by Navigator. The estate needs investment to maintain the eucalyptus trees, and, he says, “nothing better than joining forces with a company that works directly with cellulose to get advice, either on smoothing and preparing the land or else on supplies of plants and fertilisers”. The aim “is to achieve the best yields from the eucalyptus plantation, to extract wood with the best quality for the industry”. The strategies of the Winwood programme include “precise and detailed monitoring of what’s happening on the ground in terms of species growth”, he explains.

Before joining the programme, maintaining the eucalyptus plantation was one of this producer’s greatest worries. Now it’s less of a strain, “both with the financial support and with the advice on different operations - fertilising, thinning, control of pests and diseases”.

Francisco Freire also points out that “the programme groups several forestry landowners together to create synergies and encourage teamwork”. This joint approach “makes us faster and more effective not just in operations in the field, but also in response to crises, such as forest fires”. ●



On the Marvila Estate, in the district of Portalegre, 190 hectares of eucalyptus were planted with technical supervision from The Navigator Company

“The joint approach makes us faster and more effective not just in operations in the field, but also in response to crises, such as forest fires.”

Working together for the forest of the future

The main aims of Navigator’s new Forestry Producers Club are to increase the area of well-managed forests, to stop land being abandoned, to increase the value of the forestry sector, and to make it more attractive, thereby leading to rejuvenation.

Navigator’s Forestry Producers Club is one of its latest and most innovative initiatives aimed at all those who make their living from forestry in Portugal, and is based on an idea as simple as it is revolutionary: “Working together for the forest”. Launched in November 2023, the Club already has around 150 members, demonstrating the need to join forces to build a stronger and more dynamic forestry sector.

“What prompted us to set up the Club was our realisation that operators in the eucalyptus sector play a vital role in forestry and that it was a priority for us to build stronger ties with producers, wood suppliers, service providers, associations, and public authorities”, explained João Lé, executive director of The Navigator Company. “This initiative is focused on developing the skills and expertise of different partners in the forestry sector, so they can contribute more to increasing yields and national output of eucalyptus wood, disseminating sustainable and active management practices in forests”, he added.

Paulo Santos, coordinator of Navigator’s Forestry Project, confirms this: “With the Club, we wanted to continue efforts to increase the area of forest under effective management, we want this to be a driving force for modernising the sector.” The idea of working together - which has been a reality from the start, as the Club grew out of a collaborative process involving various operators in the sector - is both an underlying principle and a means of achieving our aims: “We need to work with our partners, to make them more sustainable and competitive in the medium and long term”, explains Paulo Santos. “Because only with expert and competitive companies will it be possible to have efficient forests in the future. And it’s the future we’re working for”, he concluded.



Environmental and social benefits

Collaborative action on a large scale is an essential way forward for achieving the Club’s goals. A process that also means investment in empowering and developing the different operators, both through innovation in equipment and also by attracting, valuing, and retaining human resources.

By increasing the area of well-managed forests, the Forestry Producers Club will also bring environmental and social gains: a reduction in fire risks, less CO2 emissions and increased sequestration, promotion of biodiversity, with more conservation areas, and renewed energy in the economy of inland regions, combating desertification. Because forests are an asset that brings benefits and positive aspects to communities, that go beyond income and livelihoods, the Club aspires to engage various sectors of society. ●

Action

The Forestry Producers Club focuses on five main areas of action, seeking to build close ties, increase investment, and strengthen the commitment between partners:

- Maximise yields;
- Act on a broad scale;
- Ensure cost efficiency;
- Training operators;
- Add value to assets.



Scan the QR Code to learn more about Navigator’s Forestry Producers Club.

More than a workplace

Navigating the secrets of the forest is a daily mission which for many people is more than just a job. From wildlife conservationists to scientists, from loggers to archaeologists, each individual has their own unique story, woven beneath the branches and into the depths of the soil. From those who work directly to protect woodlands to those to exploit their potential on a sustainable basis, they all help ensure that our forests continue to perform their vital role in balancing ecosystems. Because forests are more than just a workplace - they're a home, a sanctuary, and an inexhaustible source of inspiration.

João Silva

Mycologist

“Being able to earn my living in the forest is a privilege”

Identifying mushrooms and other fungi is almost a mission for João Silva. That's why he spends much of his time in the forest. “I've always had a great love for nature. From an early age I wanted to be a biologist, but that never actually happened”, he tells us. But he fulfilled his dream of working in communion with nature, and not between the four walls of an office.

At Verde, an association for integrated nature conservation, where he is responsible for an inventory of trees in public places and forestry parks, working alongside a forestry engineer, he devotes himself to “exploring the forest, through uplands and valleys”. “We are hired by the municipal authorities and, depending on the size of the municipality, the job can take between four months and a year”, he explains.

On top of his job surveying woodlands, from October to January each year João Silva has another occupation that he is passionate about: “I identify mushrooms and other fungi on trees and I give workshops on the subject”, he tells us. “But, whatever it's for, working with nature and being able to earn my living in the forest is a real privilege”. ●

Rogério Cangarato

Ornithologist

“We need to strengthen people’s cultural and emotional connection with forests”

“My father used to hunt and that’s how I first got to know the forest and the countryside. But I was keener on my binoculars, and my father eventually gave up his gun.” Rogério Cangarato regards himself as a “self-taught ornithologist”, because he never studied biology, but he started birdwatching “while at secondary school, with a group of friends who shared his interest.”

He found a job at the Iberian Birdlife Research Centre, where he started to work with Navigator. Today, he’s a consultant and works with the company at the Espirra Estate, “on installing artificial nests for insect-eating birds, and also helping to monitor the project”.

He’s also involved in preserving the Bonelli’s eagle in southern Portugal. “It’s an endangered and priority species at the European level. That means specific conservation measures have been adopted, as the birds tend to stay in the same place for decades if the nests are preserved, through responsible forestry management”, he explained.

“We need to strengthen people’s cultural and emotional connection with forests”, he says, because only then “will everyone be more aware of the need to preserve and protect them”.



Pedro Henriques

Entomologist

**“I feel at home
in the forest”**

He discovered a passion for nature at an early age. “When I was five, my father would take me into the woods, and I quickly got interested in observing animals”, recalls Pedro Henriques, now a researcher who has studied birds and insects for more than 20 years.

In 2012, he founded Clube Xzen, an educational association in the fields of culture, science, and sustainable development, whose motto is “changing mentalities” about insects. “Our idea is for children, at just three or four years old, to have contact with insects, and to touch them, helping to break down preconceived ideas. Most insects are not dangerous”, he assures us. “There’s just five percent with which you need to be careful”, he points out. His research has led him to two important discoveries in forest plantations. “In 2012, I rediscovered the hoverfly, crucial for pollination, which had not been recorded in Portugal since 1948. And in 2016 I found a new species, never recorded in this country - the nocturnal butterfly, which I started to study in 2017”, he told us.

Pedro Henriques feels he belongs to the forest habitat: “It’s where I feel at home”. ●

Rui Mataloto

Archaeologist

“Archaeological sites are often to found in forests”

Rui Mataloto's deep connection with the forest dates back a long way and started through his work: “A lot of things connect archaeology to forests. Our job is to understand where there has been human occupation, down the ages. We work to preserve archaeological sites, which are often found in forests”, explained the archaeologist for the municipality of Redondo (Alentejo), who since 2018 has coordinated the excavations at Castelo Velho da Serra d'Ossa. “We've worked over an area of 10 hectares, located on a property owned by The Navigator Company. We have teams of volunteers, especially students from foreign universities, who help with the archaeological excavations in the summer”, he tells us. For everything to work, the company's safety arrangements are crucial: “It's what enables us to work in the heart of the forest, in August. We're in constant contact with Navigator's staff”. This coordination has been essential, enabling the archaeologists to make significant finds: “We've found traces of occupation, such as pieces of ceramics, fireplaces, and circular huts, from the late Bronze Age, in other words, three thousand years old.” ●



**Patrícia Moreira**

Researcher

“It was really interesting to work on the basis of the green forest economy”

Patrícia Moreira had no hesitation in accepting an invitation, made to her in 2018, to join the Inpactus Project, researching innovative eucalyptus-based products and technologies. “The idea was to make use of all the forestry waste from eucalyptus and acacia to extract bioactive compounds that could bring benefits in fighting Alzheimer’s and could also be used in skincare products”, she explains. “But I never imagined we’d reach the end of the project with such good results”, she confesses. “Over four years, we conducted behavioural tests with eucalyptus plantations oil on transgenic mice, and there were visible changes in memory and anxiety, as well as alterations in the skin”, Patrícia told us.

Acknowledging that little is invested in studying Alzheimer’s disease, because of the “low success rate which is expected, given the existing lack of knowledge”, Patrícia Moreira believes that wider dissemination of the findings of the Inpactus Project could help to change attitudes.

Now working in a biotechnology company, she has fond memories of her forest-based research. “It was really interesting to work on the basis of the green forest economy, making use of materials that previously went to waste.” ●

**Vânia Oliveira**

Land Use Officer

“In the forest, we learn something new every day”

Vânia Oliveira studied for a degree in Environmental Engineering, but for 14 years she's worked in forest management and loves what she does “It's a very rewarding job. You get out into the country, talk to people and listen to them, get involved locally”.

And what exactly does a land use officer do? “My job is to ensure that agro-forestry holdings are used for multiple purposes, helping to make them economically, socially and environmentally viable and useful. By selling forestry products other than wood, such as cork, pine cones, and other services and activities related to woodlands, such as shooting and grazing for cattle”, she explains.

Working in the countryside is an education. “The things I learn out in the field, I'd never learn anywhere else. In the forest, we learn something new every day. and locally, everyone knows the value of forests, but people still have a lot to learn about what forestry management means, especially people who are not from rural communities”, she tells us.

How can people be educated? “Through the media, schools... Children should be taught a greater awareness of what forests can offer and we have to work to preserve them.” ●

Tiago Rodrigues

Chainsaw operators
team leader

“I ended up falling in love with forestry work”

After 22 years of feeling passionate about forests, Tiago Rodrigues tells us that this enthusiasm is what enables him to lead the team of chainsaw operators at Leitão & Cavaleiro, a company based in Coimbra that specialises in forest maintenance. “I dropped out of education to join the company and I ended up falling in love with it”, he recalls, although he admits “it’s a tough job, and we often work in poor conditions.”

Most of his work is in forest maintenance, which can involve marking out in the field, planting, fertilising, and applying plant protection products. “As team leader”, explains Tiago Rodrigues, “I prepare the work plan for the next day, and also the machines and equipment needed, and then I brief the rest of the team”.

Looking at the forestry sector today, he admits it can be hard to attract people to work in the sector. But there have also been positive changes: “There’s training now, which there wasn’t when I started. And these days we have to wear personal protective equipment, which makes it safer for everyone, and we have to comply with the rules on protecting water courses, ponds, rivers, and structures in ruins, which is all essential for managing forests correctly” ●



Left to right: Albano Gomes, Tiago Nogueira, Tiago Rodrigues, Ricardo Correia, Carlos Neves and Renato Rodrigues

António Aires

Forestry engineer

“I feel I have
to give back
to nature”

António Aires manages a team of five people who are in charge of 35 thousand hectares of forest. There are 4,462 plots and 447 properties, across 17 municipalities and 46 freguesias or parishes. There are also hundreds of species of fauna and flora. “We’re very proud of what we do, generating value through forests”, he says.

He trained as a forestry engineer and has worked at The Navigator Company for 22 years, currently as Southern Region Forestry Production and Operations Coordinator. At the end of the day, he confesses that what motivates him is the desire to “give back to nature.”

This was the spirit in which he came up with the project currently being implemented at the Espirra Estate in Pegões, designed to boost populations of pollinator insects, by seeding particular species that attract them, thereby promoting biodiversity. The project also seeks to increase the availability of water, fruits, and seeds, enabling populations of fish, amphibians, reptiles, birds, and mammals to grow. “We want this project to serve as an example. At Navigator, we’re trained to respect nature and the forest, and this project has grown out of that respect”, he explains. ●





The planet's biodiversity depends on forests

Forests are home to most of our terrestrial biodiversity. Countless ecosystem services vital for mankind are dependent on this wealth of species.

Black storks nest in crags or else in large trees with generous crowns.

The State of the World's Forests 2022 (SOFO 2022), a report by the United Nations Food and Agriculture Organisation (FAO), warns that the conservation of global biodiversity is entirely dependent on how we interact with and use forests. This is easy to understand if we consider that these ecosystems are home to most of the planet's terrestrial biodiversity, providing the conditions they need to live. Even though our evolving knowledge of planetary biodiversity cannot give us any accurate figures, it is commonly agreed that forests and woodlands are home to 80% of the Earth's terrestrial plants and animals. The world's forests contain more than 60,000 species of trees and are home to 80 percent of amphibian species, 75 percent of bird species, and 68 percent of all species of mammals. The figures are from the FAO which, in calling for action, has stressed the importance of these ecosystems: "We need to take bold actions to reverse the loss of forests and their biodiversity, for the benefit of current and future generations".

Losing forests means losing biodiversity

Forests cover 31 percent of the world's land, corresponding to an area of 4.06 billion hectares, reports the FAO, in Global Forest Resources Assessment 2020, the latest available version of one of the best resources for finding out about the current state of forests around the world. Ten thousand years ago, these figures were 57% and 6 billion hectares, according to Our World Data, which also shows that the alarming reduction in the global area of forest has not been constant over time: in just over one hundred years, the world lost as much forest as in the previous nine thousand years - an area the size of the United States. According to figures from SOFO 2020,

between 1990 and 2030, i.e. in just thirty years, 420 million hectares of forest were lost to deforestation - an area the size of the European Union. Although the rate of deforestation is slowing, it was still at 10 million hectares a year from 2015 to 2020. And around 47 million hectares of primary forests disappeared between 2000 and 2020. Conversion of forest to farmland is regarded as the main cause of his loss of forests. According to Our World in Data, almost half the habitable area of the planet (44%) is occupied for farming purposes, including pasture and crops for livestock, and agricultural crops to feed people. This scenario poses one of the most urgent threats to the planet's biological diversity and the balance of forest ecosystem services. Forests supply us with water and provide livelihoods for millions of people around the world. Forests are also fundamental in mitigating climate change and are essential for sustainable food production. The importance of forests lies in their providing a home for pollinators (such as bees, bats, butterflies, etc.), which, according to the FAO, are vital for 70% of the world's food crops and pollination of 87.5% of wild plants.

The chain of life

The biodiversity of forests encompasses all the life forms we find there, from trees to micro-organisms, including animals and a countless array of plants - and also the ecological roles they all play. In other words, according to the FAO, "the biological diversity of forests should be considered at different levels, including at ecosystem, landscape, species, population, and genetic level. Complex interactions occur between - and within - these levels, "enabling organisms to adapt to constantly changing environmental conditions and to maintain ecosystem functions". Trees provide food (leaves, fruit, seeds, flowers, pollen, bark, and

The conservation of global biodiversity depends entirely on how we interact with and use forests.



Each square kilometre of forest may be inhabited by over a thousand species.



Deer



Heather

roots), shelter, and breeding grounds for many animals. And they're not just useful during their lifetimes. Even dead trees are used by birds, small mammals, and other wildlife, for storage, nesting, food, and shelter. In addition, fallen trunks retain moisture and the nutrients that help new plants grow and feed organisms in the soil. All the species across the spectrum of forest biodiversity belong and contribute in countless ways to a balance that is as awe-inspiring as it is fragile. Some of these ways are familiar to us, such as the food that trees provide to countless species of living beings, or the fact that the excrement and cadavers of animals enrich the organic matter in the soil, providing nutrients for the plants in the ecosystem. Others are less well-known, but just as important. For example, when insects "attack" and "kill" a tree, it is normally the weakest individual, contributing to a healthier genetic heritage and a more diverse forest structure, as well as letting more light into the habitat. Also very useful is the "work" of small herbivores who diligently eat branches and shrubs, thinning the undergrowth and the potential fire fuel. These small animals also play an important role in helping to disperse seeds, often over a considerable distance. It is estimated that a single squirrel can disperse 20 thousand pine cones in a year! This is an intricate web which means that each square kilometre of forest may be inhabited by over a thousand species. Each one counts. Each one is important. ●



Eucalyptus
Eucalyptus globulus



Arbutus
Arbutus unedo

Planted forests
and protecting
biodiversity

A commitment to



Black stork
Ciconia nigra



Mole
Talpa occidentalis

Forests that are planted to produce wood can play an important role in conserving biological diversity. There are plentiful examples of how the two aims can be harmoniously conciliated, through responsible forestry management, bringing positive impacts for people and the planet.

“Trees, forests and sustainable forestry” can “help the world combat climate change and biodiversity loss. But this requires greater recognition from society of the considerable value of forests and their crucial role in building inclusive, resilient, and sustainable economies.” With these words, the United Nations Food and Agriculture Organisation (FAO) stresses the importance of planted forests, when sustainably managed, not just for combating climate change, but also for the urgent task of reversing global biodiversity loss (The State of the World’s Forests 2022). Production forests are not the “green deserts” they are often accused of being. They provide a home for some species, others use them to procreate, and for others, they offer shelter or a place of passage between different habitats. Connectivity is highly important and planted forests serve as ecological

corridors, allowing for the natural dispersal of species and genetic interchange between populations. But they also play a significant role in maintaining Areas of Conservation Interest, as required by certified responsible management. “Of course, these forests do not have the same wealth of biodiversity, as they are non-native forests, planted for production purposes. But they cannot be written off as a ‘green desert’, we know there are ways and means for minimising their impact on biodiversity”, says Miguel Rosalino, researcher and lecturer at the University of Lisbon’s Faculty of Sciences. “We know there are species that use eucalyptus forests, even if it is not their natural habitat. The plantations can be permeable, and this is beneficial. It’s possible to do things to ensure they are not sealed-off areas”, explained Miguel Rosalino, who argued that we need “to know more about species that can live

in eucalyptus forests, or use them, and to find out more about what variations there are in the biodiversity of eucalyptus forests planted for production but with differing characteristics.” Nuno Rico, biodiversity conservation officer at Navigator, corroborates this idea: “Even for species that don’t live in these forests, they can serve as hunting territories or areas of passage”. But production forests can also function as a complementary habitat for woodland-dwelling species. Examples of this are the Bonelli’s eagle and the goshawk (endangered species), which choose older, medium to large trees to build their nests, and can be found in tall eucalyptus plantations near or on some of the holdings managed by Navigator, where they are protected. Research conducted in Portugal and Spain shows that Iberian eucalyptus forests present a species richness on an average 30% lower than natural forests, which is rather different from

the idea of a “green desert”. And even this figure varies, depending on the age of the plantations. In mature eucalyptus forests, for example, bats were found to be more active and the pattern of bird and lichen occurrence in young plantations is close to in scrubland and evolves to levels similar in all regards to those recorded in natural forests, in the case of older eucalyptus woodlands.

Responsible management makes a difference

It is sustainable forestry management practices that make the difference in conserving biodiversity on holdings given over to production forests. In mainland Portugal, the 107 thousand hectares of forests for which The Navigator Company is responsible are actively managed, with a firm commitment at all times to improving and protecting woodlands. 100% of this area is certified under the

Some species live in production forests, others use them as a breeding ground, or as shelter or a place of passage between habitats.



Iberian midwife toad
Alytes cisternasii

The biological diversity found in the forests managed by The Navigator Company is represented in an exclusive collection of engravings by the scientific illustrator Mafalda Paiva.



Eucalipto
Eucalyptus globulus

The strategy of conserving and promoting biodiversity followed by Navigator takes a holistic approach to ecosystems because by improving the habitat conditions, it is encouraging the presence of all the species that depend on it.

international schemes of the Forest Stewardship Council (license no. FSC®-C010852) and the Programme for the Endorsement of Forest Certification (license no. PEFC/13-23-001).

On the forest holdings managed by the Company, there is space for areas given over solely to conserving biodiversity. In other words, the forests here are managed not for production, but merely to conserve or improve the state of habitats. On the properties under Navigator's management, these areas are larger than required by the certification schemes, and in 2023 corresponded to 12.19% of the total area. These are called Conservation Interest Zones (CiZ) and are important habitats for a range of flora and fauna, including species with different conservation and protection statuses, and endemic species.

Within the CiZs, there are 4,420 hectares classified as protected habitats by the Natura 2000 Network and also Areas of High Conservation Value (AHCV) – an FSC certification concept, which entails additional protection measures, including more regular monitoring, given the presence of environmental, social and cultural features of exceptional value, so that

they are safeguarded.

Navigator's responsible management also includes combating factors that lead to deforestation and degradation of woodlands, as set out in the Forest Sector SDG Roadmap, drawn up as a guide by the World Business Council for Sustainable Development (WBCSD) to help the forestry sector adjust to the Sustainable Development Goals. "We have pursued a planned strategy of biodiversity conservation and promotion since 2008, with the aim of conciliating production aims with conservation, whilst also responding to forest certification indicators", explains Nuno Rico. "We take care not just to ensure 'no net loss' – in other words, no loss of biodiversity as a result of our operations – but also, whenever possible, to create a net positive gain", he told us. In the following pages, you can discover examples of what The Navigator Company, mentor of the My Planet projects, has done in practice not just to conserve the existing biodiversity, but also to increase the number of species and population sizes in particular habitats. ●

Goshawk
Accipiter gentilis



Monitoring: first line of protection

To actively conserve biodiversity, you need reliable information on the existing wildlife. Monitoring is therefore a key tool in responsible forest management. Around 1,000 species and subspecies of flora and 253 species of fauna have been identified in woodlands managed by The Navigator Company in mainland Portugal. These holdings contain 51 different habitat types included in the Habitats Directive. The monitoring programme is conducted each year in the spring, normally from April to June.

As it is not possible to observe all the properties individually, a representative sample is chosen for which we assess the habitats, the type of vegetation, the species present and potential species, and the state of conservation. Experts are hired to help with the monitoring and the findings enable us to adjust the conservation measures and strategies to be adopted in the following year. ●

The stunning rare rhododendron discovered in Oliveira de Azeméis

In 2023, The Navigator Company's monitoring programme identified a well-conserved habitat on a property in Oliveira de Azeméis, consisting of a community of rhododendrons. This is a rare species, endemic to the Iberian Peninsula, and a relic from ancient Laurissilva forests. These communities are normally found in two clusters, one in the Vouga valley (Cambarinho woods and other dispersed areas) and in the Monchique hills, and other smaller ranges to the north. Located outside these areas, this community represents a significant sub-population. The area, through which a water course runs, was already protected because it falls within the Natura 2000 Network Directive, but it will now be monitored more regularly, to track the presence of the species. "We're going to assess the best way to maintain and improve the state of conservation of the habitat and, if possible, increase the size of this rhododendron community", we were assured by Nuno Rico, Navigator's biodiversity conservation manager. ●



Kingfishers
Alcedo atthis

European hedgehog
Erinaceus europaeus



Habitat restoration: when intervention is needed

Action to restore ecosystems and rehabilitate habitats is one of the central planks of the conservation and biodiversity strategy pursued by The Navigator Company. The Company takes a holistic approach to ecosystems because by improving the habitat conditions, it is encouraging the presence of all the species that depend on it. Restoration work was carried out in 2023 over approximately 191 hectares, to maintain or improve the state of conservation of natural and semi-natural habitats. The Zambujo reCover project is the largest in terms of size and impact. This restoration initiative involves an area of 110 hectares - equivalent to 110 football pitches - on the Zambujo estate, in the municipality of Idanha-a-Nova, district of Castelo Branco, in the heart of the International Tagus Natural Park. The aim is to boost the resilience of the habitat to the effects of desertification, climate change, and fires, by promoting stands of trees and shrubs with an ecology adapted to drought and arid conditions. The main species being nurtured is the holm oak (*Quercus rotundifolia*).

The project started in 2022 and is funded by the COMPETE 2020 Programme, under the measure for "Support for climate transition/Resilience of territories in the face of risk: Fighting desertification through reforestation and action to fix carbon and nutrients in the soil" (REACT-EU/ERDF). Most of the work in the field was carried out throughout 2023: The first phase consisted of felling eucalyptus and devitalising the stumps, planting holm oak, selective clearance of vegetation to promote regeneration of forestry and pre-forestry specific characteristics of holm oak woodlands, and pruning to help the existing trees assert their dominance. The second phase will consist of monitoring how the restored area evolves and intervening as necessary to achieve the ultimate aims, seeking to measure the positive impact on biodiversity. Around 40 hectares of production forest have been converted to holm oak woodlands. In the remaining intervention area, work will be done to improve the state of conservation of the naturally occurring holm oak woodlands. ●



Monchique Oak
Quercus canariensis

Recovery of the Monchique oak

The Monchique oak (*Quercus canariensis*) is a species classified as critically endangered on the Mainland Portugal Vascular Flora Red List, due to the continued decline of the population in Portugal. It is a relic of the primordial forests that covered southern European but is today extremely rare and threatened by habitat destruction and natural hybridisation with the Portuguese oak.

The species has benefited from conservation work in Navigator's forests, especially on the company's estate at Águas Alves, in the Monchique uplands, home to several habitats in the Natura 2000 Network. As well as efforts to disperse acorns, Monchique oaks have been planted since 2019. "Acorns were gathered on the property, developed at the Espirra nurseries and have come back home to be planted," explained Tiago Damas, who manages the property.

A new opportunity to help in the recovery of this species arose with the Transform Mobilising Agenda, under the Recovery and Resilience Plan (RRP). The project, entitled "p1.1 Genetic improvement, production and conservation of forestry reproduction materials", sets out to improve the

resilience of Portuguese forests in the face of the effects of climate change. With a time horizon of three years, from 2022 to 2025, it is coordinated jointly by RAIZ (the forest and paper R&D institute owned by The Navigator Company, the University of Aveiro, the University of Coimbra, and Lisbon University's Higher Institute of Agronomy) and INIAV (National Institute for Agrarian and Veterinary Research), in partnership with Navigator's forestry division, the Castelo Branco Polytechnic Institute and Viveiros Aliança. In 2023, the first visits to the field were made with support from BIOPOLIS-CIBIO (Research Centre for Biodiversity and Genetic Resources) and the University of Porto Botanical Gardens. The teams collected genetic materials, characterised and mapped the species, and undertook the molecular characterisation of the trees selected, using genomics tools, to identify individuals which typify the species, analyse the potential degree of hybridisation with the Portuguese oak and characterise the diversity of Portuguese sub-populations of this species. The material collected is now at Viveiros Aliança and the Castelo Branco Polytechnic Institute for vegetative propagation trials. ●



Bonelli's eagle
Aquila fasciata

Bonelli's eagle and old eucalyptus trees

Bonelli's eagle (*Aquila fasciata*), classified as an endangered species, nests on several of The Navigator Company's properties in the south-west Alentejo and in the Algarve, and has been monitored by the company since 2006.

The species usually nests in rocky outcrops, in inaccessible and isolated places. But according to the Portuguese Society for the Study of Birds (SPEA), the Bonelli's eagles in Portugal, especially in the south-west Alentejo, behave rather differently: most (around 70% of pairs) nest in trees, which has helped the species expand, as it is no longer limited to crags. This is precisely what has happened on some of Navigator's estates, where nests of Bonelli's eagles have been identified for several years, built at the top of eucalyptus trees.

As part of the LIFE project (Conservation of Arboreal Populations of the Bonelli's eagle in Portugal), the Company has worked with CEAI (Iberian Birdlife Research Centre) to draw up a conservation plan establishing buffer zones around nests. There are buffer zones on 32 Navigator properties, corresponding to 16 territories for Bonelli's eagles, i.e. 16 breeding pairs. As well as this, there are four nests, or stable nesting sites, on our estates, around which protection areas of between 3 and 4.5 hectares have been established. These have been considered "high conservation value areas".

A critical period has been identified, during which certain operations are subject to restrictions. "We have to manage the plantation in a way compatible with the Bonelli's eagle's breeding season. We monitor the nests each year and restrict some disruptive activities, such as felling or planting trees, between December and May," explained Nuno Rico, Navigator's biodiversity conservation manager.

There is also a concern to create alternative nesting sites, by setting up or maintaining small clusters of large trees around existing nests and building artificial nests. "The natural nests are in trees that sometimes dry up or fall, and it's good to have alternatives," explained Nuno Rico. "The population has remained stable, and whenever the birds succeed in breeding, we're hopeful that the juveniles will nest elsewhere," he told us. ●



European Robin
Erithacus rubecula



European pond turtle
Emys orbicularis

Seeding plants to attract pollinator insects on the Espirra Estate



Species of pollinator insects are in worrying decline around the world, with grievous consequences for the balance of ecosystems and for agricultural crops. On the Espirra Estate, in Pegões, district of Setúbal, The Navigator Company is sowing plants to attract these insects. The project is intended to help increase biodiversity.

A preliminary trial sought to gauge the impact of sowing these plants on the diversity of pollinator species, and on the size of populations. The results were monitored by the Clube Xzen Association, which surveyed the insect populations on two

plots of land: one where several species of plants that attract pollinators were sown, and another without any intervention. In the areas seeded, almost twice as many species were detected than in those not seeded. The insects observed included several true bugs (Hemiptera), butterflies (Lepidoptera), and ladybirds (Coleoptera), due to the greater number of flowers. It was possible to conclude that the sowing of flower species considerably increased the diversity of pollinators in the area. ●



Tomilho-do-mato
Thymus capitellatus



European polecat
Mustela putorius

Serras do Porto Park: rare species, people and planted forests



The Serras do Porto Park, the largest swathe of forest in the Porto Metropolitan Area, is an example of how the aims of production and biodiversity protection are not mutually exclusive and can work hand in hand. The Park stretches over 6 thousand hectares, 22% of it is managed by Navigator, on land it owns or rents, much of it for decades. All year round, especially at weekends, the park buzzes with activity. Families and groups of friends, or people on their own, flock here to hike or cycle. The contact with nature makes it even more appealing, knowing that, along the way, they may encounter rare or especially interesting species: such as an insect-eating plant, the Portuguese sundew (*Drosophyllum lusitanicum*) or the gold-striped salamander (*Chioglossa lusitanica*), an amphibian endemic to the north-west of the Iberian Peninsula, whose conservation status is “vulnerable”.

The Serras do Porto Park offers a clear picture of how the forests’ different functions can work in harmony: serving the objectives of the forestry producers operating here, providing an area for recreation, and, thanks to the control of undergrowth, protecting cork oaks and arbutus trees and reducing the risk of fires. João Melo Bandeira, Navigator’s Forestry Operations and Production Manager, has no doubt that a virtuous circle has been created in the area through a management approach that protects forests: “When protection brings positive effects, people start to like these areas, and they attach more importance to protecting them.”

The Life Serras do Porto project was launched in 2023, to adapt the area to climate change. Navigator is a project in this initiative that involves an integrated array of interventions with significant positive impacts on the landscape and ecosystems, through monitoring, reporting, awareness raising, and civic engagement. ●



Due to its shorter cultivation cycle, eucalyptus sequesters more carbon than other trees. On average, each tree sequesters 136 kg CO₂ /year.